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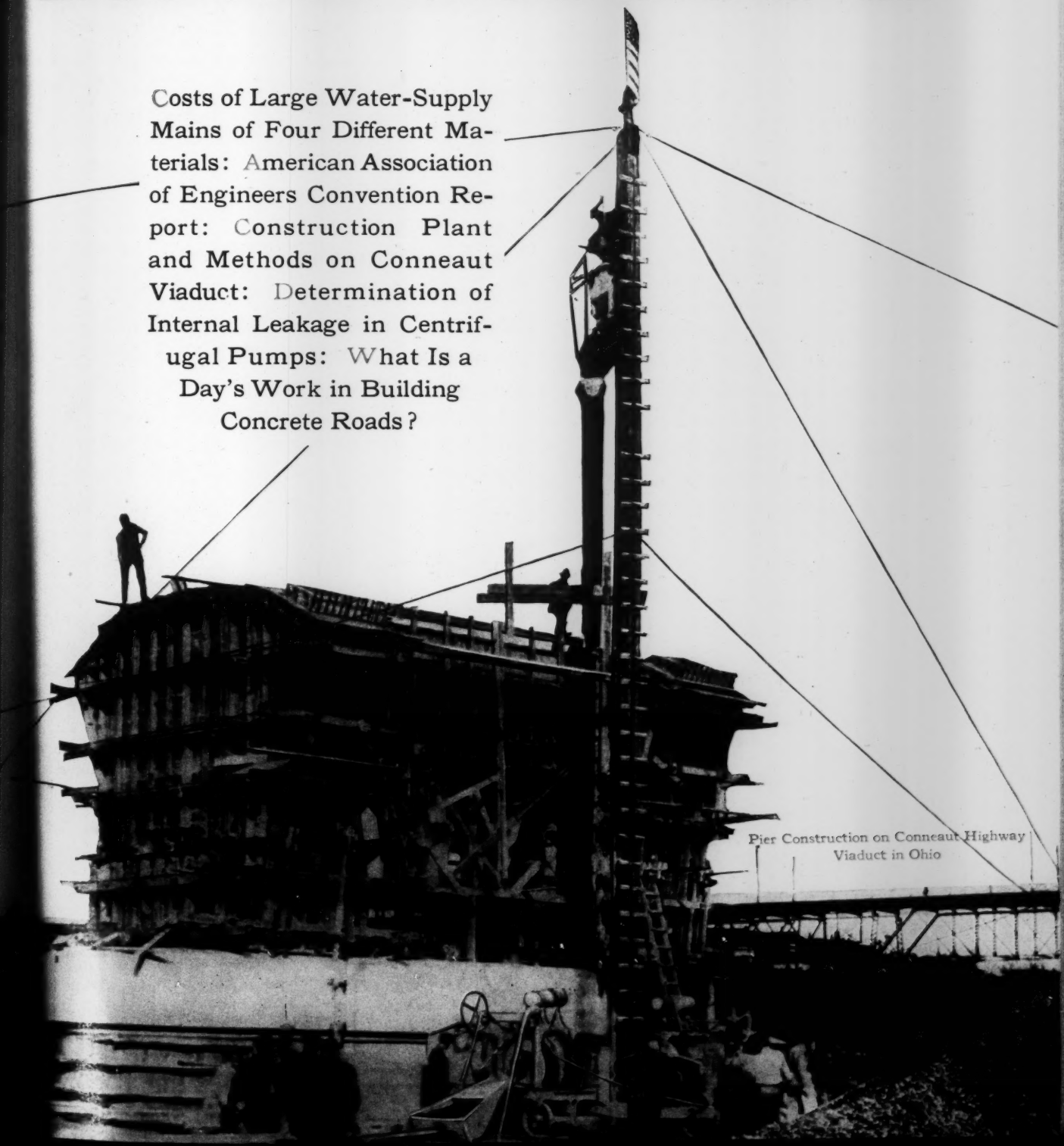
Engineering News-Record

Costs of Large Water-Supply Mains of Four Different Materials: American Association of Engineers Convention Report: Construction Plant and Methods on Conneaut Viaduct: Determination of Internal Leakage in Centrifugal Pumps: What Is a Day's Work in Building Concrete Roads?



Pier Construction on Conneaut Highway Viaduct in Ohio

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ENGINEERING NEWS-RECORD

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DEVOTED TO CIVIL ENGINEERING AND CONTRACTING

FRANK C. WIGHT
Editor

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Contractor and Engineer

DECISION OF an important contract case last week promises to clear up some of the uncertainty surrounding the mutual rights and obligations of the parties to a construction contract. Holbrook, Cabot & Rollins, contractors for the completion of the outfall tunnel of the ill-fated Passaic Valley sewer, rescinded their contract a year ago on the claim that they had been misled by the information as to soil conditions furnished in the call for bids. This action was the more startling because two previous contractors for the tunnel had sustained overwhelming losses on the work, and one of these, the O'Rourke Engineering Construction Co., had made similar charges of misrepresentation. However startling, the charge is upheld by the outcome of the suit. A verdict for the full damages claimed, $805,600, was found for Holbrook, Cabot & Rollins. The details of the court finding are not yet available in full; we hope to be able to give them next week. But it is already apparent that the legal principles laid down in the case make it the engineer's obligation to avoid any possible misleading—intentional or unintentional—of the contractor. The engineer may require the contractor to take a gamble on the job, but he must enable the contractor to judge whether he must gamble or not. Bland disclaimers as to the correctness of information offered are of doubtful legal effect. All this agrees with ordinary honesty and good sense. However, even if it should turn out that the decision goes no farther in making new law than to reaffirm the principle that a contract must be framed on a square-deal basis, it will establish a most valuable precedent.

Four Choices Compared

FOR direct and suggestive value and as an illustration of current methods of study in designing engineering works Mr. Maury's paper on the relative advantages and disadvantages of four materials for large water-supply pipe lines, abstracted elsewhere in this issue, is notable. Years ago engineers attempted no choice of materials for a pipe line—at least not unless forced by local or regional conditions, such as high freight rates of difficult country to accept something other than cast-iron pipe, even if they felt it involved risk of integrity or short life. Today Mr. Maury is able to weigh and balance four materials. To reduce them to a comparable basis of cost such factors as relative life, friction losses and compensation for the latter by pumping were taken into account. The discussion of the paper from the floor, cut short by time limitations, reflected the many-sidedness of the subject. A number of the points raised by the paper and discussion also apply equally to the choice of material for pipe distribution systems. If some of the materials considered would be unavailable for street mains there are others that might be considered in their place. In view of this, together with current high prices of cast-iron pipe, complaints about coating and a desire for a revision of specifications which the manufacturers have been unwilling to meet, it is evident that the cast-iron pipe makers are to be confronted with increasing competition as time goes on. Such studies as that of Mr. Maury may well be extended to smaller pipe.

Getting Organized Action

A CHANGE has taken place in the attitude of engineers toward problems of public interest. Up to a few years ago the individual engineer had no means of getting together with others in joint action to influence community thought and action, and accordingly he made little or no attempt to exert such influence. The technical societies have always stood aloof from public affairs and properly so, except where a well-defined technical problem was at issue. Organizations outside the technical field did not exist. Now, with two such organizations in existence, the American Engineering Council and the American Association of Engineers, engineers realize their opportunity and responsibility. The study given to two important questions by the latter organization during the past year exemplifies this; the relation of taxation difficulties to public works, and the problems of land reclamation and settlement, were studied to good effect. The study of reclamation in particular was guided by insight and skill, and is sure to prove helpful in the ultimate adjustment of the subject. If the work of the association stops with the recording of this committee action, however, little will be accomplished. Reports of committees, be they ever so good, are likely to be of vanishingly small effect unless made known, preached to the community, and urged upon legislators and officials. If the association wants to make its influence upon reclamation reform really effective, it has a splendid opportunity to do so by persistent agitation and appeal during the next six months.

A New Campaign

WHEN CONGRESS adjourned a week ago all moves to pass better reclamation laws ended in failure. It had become apparent to all during the past year that a new law must be passed. The well-being of numberless thousands is dependent upon it. Difficulties and hardships that meant misery and financial ruin to countless western families resulted from conditions not foreseen in the passage of the original law, and in consequence also the nation at large was losing money and losing the advantages of sound community development. Moreover, as the land and water conditions under which the old reclamation law was framed went out of existence, new problems came into being, so that it is evident that the future tasks of reclamation will be very different from those of the past. The pressure of these facts stimulated the long and careful study given to reclamation during the past winter, and

through this study constructive recommendations were evolved which contain a real promise of bettering the existing evils. These recommendations came before Congress in the last few minutes of the session, but they were unable to make headway through the legislative tangle and the bill expired with the adjournment of Congress. The consequence of this failure is to leave the whole situation hanging in the air, with the added certainty that each month will see the situation become more complicated and more unfortunate. The best hope now is that the reform legislation can be passed and put into effect early next winter. But this will not happen automatically. Legislative action is usually obtained only at the cost of much agitation and urging. The engineering profession, as the interest primarily concerned in the problem because of its technical qualifications, therefore, has before it the duty of carrying on the campaign which it began last year to rescue reclamation from the then threatened disintegration. It must enter upon a new campaign on the reclamation problem, to assure and safeguard the development of our land and water resources and create more favorable conditions for our human development. In such agitation lies as brilliant an opportunity for the American Association of Engineers as its most courageous leaders could wish for.

Discussing the Colorado

THAT TECHNICAL societies should concern themselves with public questions, when these are of technical character, is brought out anew, and in unusually interesting manner, by the discussion of the Colorado River problem which is on the program of the American Society of Civil Engineers this week, for its Pasadena meeting. There have been earlier discussions of the same kind, notably that on control of the Mississippi River, held last year at New Orleans, yet the present case is distinctive. The Colorado River problem is new, difficult, and fiercely contentious, and is as complicated on the technical side as on the public-policy side. Such a problem constitutes a magnificent subject for making the work of a society of technical specialists helpful to the public. Unfortunately, this helpful result rarely materializes. The discussions usually are guardedly abstract, or present partisan or personal views; and finally they are laid to rest in printed proceedings, leaving the world to go about its business and settle its questions itself. Very likely this conventional procedure will be repeated with the Colorado River discussion—a particularly regrettable result because the problem is bound to be settled somehow in the next few years, and the unprejudiced conclusions of an engineering society should be available to help in this settlement. In time it should be possible to work out a method by which the society can act upon such questions more concretely than by mere platform discussion. The country's needs are rapidly shaping themselves in such a way as to make action of this kind vitally important.

Lost Time in Road Building

THREE years' carefully kept statistics confirm the conclusion that in concrete road building fully one-third of the construction season is dissipated. The figures given in detail on another page are specifically for Iowa conditions but these cannot be greatly different from conditions in all of the middle-zone states east of the Rocky Mountains. Scattered records from elsewhere indicate closely similar conditions. Indeed the conviction cannot be escaped that could all lost time be avoided all the concrete pavement completed any year could be laid in approximately three months of continuous work. Analysis of the Iowa records need not be continued. The significant fact is that, with all which has been done to emphasize the waste of seasonal construction, in concrete paving in Iowa the conditions in 1921 were repeated in 1922 and again in 1923. This is not especially a criticism of Iowa road builders; the results everywhere in road building are similarly negative. Must we accept the fact as unchangeable? Is there no way of getting a concrete road-construction season of more than 220 days out of a year of 365 days? Out of a construction season of 220 days, is there no way by which we can get more than 90 days work? These questions are a direct challenge to road builders.

Valuable—If Properly Used

TWENTY-FOUR HUNDRED graduates of the Engineering School of Pennsylvania State College were asked by the head of the school to answer a questionnaire dealing with their professional career since leaving college. A summary of their answers, and of the deductions drawn therefrom, is given elsewhere in this issue. Less than five per cent of the graduates who replied have left the engineering field; from which fact the school authorities conclude that the usual statement to the effect that over half the engineering students leave the engineering field is incorrect. In the matter of salary, the summary shows that the average salary of men five years out of college is $3,110, and of men twenty-five years out of college $9,200. Both are remarkable figures. Remarkable, however, only in so far as they apply to the seven hundred or so graduates who replied to the questionnaire, and valuable only as a record of their status. As gages by which to determine the average salary of engineering graduates, or by which to find out what per cent of the graduates of an engineering school have gone into other fields they are of no value so long as the status of the other seventeen hundred graduates of the same school is unknown. These men are more likely to be the ones who have left the engineering field or are getting poor salaries. These facts should be appreciated in making deductions from any such compilation of statistics.

Experimental Railroading

FORD'S experiment in railroading has been brought to the attention of the public once more through the publication of "Ford's Story of His Railroad," in the current issue of *World's Work;* and once more the question is asked why the methods which Ford has used cannot be used to the same advantage on all the other railroads in the country. The question cannot be answered directly because the experiment is still in its early stages and there is no evidence that it will continue to be found to work successfully. But in case it does it has certain uncommon features which should be appreciated before judgment is passed on other railroads on the basis of what Ford has done.

The D. T. & I. R.R. is a small railroad, 455 miles

long, which can be managed with a minimum of organization not possible on a larger system. It was built as a promotion scheme and, like most such promotion railroads, was equipped with all the staff of a much larger road. Ford's first move was to dispense with much of the staff and to make some radical changes in working conditions of his employees which will be discussed later. The economies which he made by a large staff reduction are not possible on most of the railroads of the country. They are not overstaffed, generally. But Mr. Ford made other economies in staff by dispensing with the preparation of a large part of the records and statistics which so encumber the offices of the railroads. Many of these records are required by government, either federal or state, but there is a fertile field for simplification in collection of the required data and in its preservation which doubtless Mr. Ford, with his penchant for simplification, has been able to develop, and which the more hidebound corporations, either railroad or otherwise, are reluctant to undertake.

But more important than the staff reductions made on the D. T. & I. R.R. are the changes in the method of handling labor. The employees are no longer enginemen, conductors, or telegraph operators; now a man may be an engineman for one part of his eight hours and a car-repairer for the other, or a telegraph operator part of the day and a painter the rest of the time. Labor organizations are unknown, as far as the D. T. & I. is concerned, and their rules are not considered. This seemingly miraculous disposition of those problems of labor relations which have caused other railroad men so much worry has been accomplished by paying high wages. According to the *World's Work* account, the men are satisfied and there is no shortage of men willing to work under such unusual conditions.

This is probably true, but the same thing would not apply to the railroads of the country generally, for Ford is profiting by two things; first, his wages are so much higher than the average that he can always find men who are willing to be jacks-of-all-trades, and, second, his road is too small to be of much concern to the labor organizations. But once let the general level of railroad wages be raised to the same as those employed on the D. T. & I., and men would soon gravitate back to the railroads where they would only have to do their own kind of work in a day. Or, let all the railroads of the country scrap the agreements which have been built up by the various classes of railroad employees through years of struggle and the country would be paralyzed with the greatest railroad strike in history. What is now unimportant to the railroad labor organizations on account of the size of the D. T. & I. would then become a matter of life and death to them.

But, all in all, Ford is to be congratulated on what he has done, even though he has had the favorable condition of working with unlimited capital on a railroad for which he himself furnishes the bulk of the freight. While the radical changes which he has made in the working conditions of his employees may not be carried out on the railroads of the country generally, the very fact that he has dared to discard the rules which the railroad unions have established, thus throwing his methods into sharp contrast with the usual ones, may encourage other railroad officials to attempt to get rid of some of the bad features of those rules. Such a revision is sorely needed. Penalty clauses and overtime rules, however valuable as a check on unscrupulous railroad officials they may have been in the past, have long since passed their usefulness and are a continual drain on the railroad treasury. The task of revision will be a large one and will be fraught with many difficulties, but if Ford's experiment results in a move in that direction it will have been worth while.

In Smooth Waters

IT IS A great pleasure to learn from the proceedings of the San Francisco convention of the American Association of Engineers that the dangerous state in which the organization found itself a year ago has been put behind, and that the association is now moving smoothly ahead on a basis of good purpose, willing effort, and sound direction. The telegraphic report of the proceedings, printed on p. 1060, pictures this fortunate outcome of the earlier dissention very clearly. The association thus enters on a new career of growth, successful accomplishment, and beneficent influence.

It has faced and settled the major problems that then threatened its existence. Difficulties and dangers still beset its path but the convention last week showed that the two main issues have been met. By expelling three Chicago members the association showed that it is vigorously opposed to factionalism and unworthy purposes. By working ahead with entire absence of internal friction and exhibiting new vigor and forward aim in its committee reports, in convention action and in the presidential address, the association demonstrates the unselfish character and high professional rank of its motivating sentiment and ideals. President Benham's statement that the association offers opportunity for service rather than personal benefit typifies the present spirit.

Much remains to be done, and reconstruction is difficult in a young organization. There has been too frequent citation of the names of eminent members in the endeavor to prove the standing of the society; over much explaining about the membership savors of apology. Lost motion has been apparent; not all nineteen committees that reported at this convention were necessary, and it would be well if attention were first concentrated on work that is urgently needed or at least clearly within the purview of the engineer. More leaders are yet to be found or developed who can pass on to the membership at large the confidence and enthusiasm that has attended this convention—and they must be of the high character that can resist the radical tendencies so much more tempting in welfare work than in that of the technical society.

To sum up, the association has cleaned house, harmony prevails, ideals have been set high, and perhaps for the first time the association has an opportunity to do its best work. There is still the test of time to be met before the association can expect to interest older societies in affiliation plans. It must establish its ability to maintain the high ideals now espoused and demonstrate the permanency of the advantage promised. The difficulties ahead do not appear great in comparison to the fight won in reaching the association's present state. The turning point has been passed.

Construction Methods and Plant for Conneaut Viaduct

Portable Concreting Units Each Consisting of a 7-cu.ft. Mixer and a Mast Hoist Construct Seven-Span, Open-Spandrel, Arch-Rib Highway Bridge

SEVERAL small outfits easily movable about the work were found to possess a decided economic advantage over a large unit, like a cableway or a gravity chuting plant, in building the new 12,000-cu.yd. concrete road bridge at Conneaut, Ohio. Nowhere on the work was heavy stationary plant employed, unless one counts the trestle-track across the valley for the locomotive crane used in handling forms and centers. The locomotive crane was the largest equipment unit. On the falsework there was only a light, portable derrick and on the ground there were four 7-cu.ft. mixers and two or three mast hoists. Altogether few less spectacular outfits have ever been used for large concrete bridge construction. Its effectiveness commands attention.

As indicated by the elevation, Fig. 1, the structure to be built consisted of seven equal spans of the open-spandrel, arch-rib type with four spans of arched-girder approach at one end and two spans at the other end. The total length of concrete structure was 1317 ft., its width over-all was 46 ft. and at the creek the finished grade was 84 ft. above water level. Only shallow pier footings were required. There were about 12,000 cu.yd. of concrete and 1,100 tons of reinforcement to be placed. General dimensions and valley profile are seen in Fig. 1.

Pier and Foundation Work—Economics of plant selection can be more clearly discussed following a description of the equipment and construction methods as employed. Foundation and pier construction was the first task and its attack was complicated somewhat by the season. The contract was awarded in August and Aug. 15 was as early as excavation for the footings could be got under way. This work was sublet to local contractors and was comparatively simple, consisting of cofferdammed pits sunk to shale about 7 ft. below water level. About Sept. 1 was the earliest that work on any of the pier masonry could begin. The situation then was (1) cold weather for concreting only two months away and (2) late winter and spring flood conditions in the valley.

The general construction plans contemplated the use of a locomotive crane with the track on embankment and trestle across the valley on the south side of the bridge. For this track the crane was to work on both piers and arches. As the experience in the valley with ice gorges and freshets was looked into, doubt arose of the wisdom of subjecting a crane track to the hazards. Its construction was, therefore, abandoned until after the spring flood season, and events proved the decision a wise one. In the late winter a thawing flood swept down the valley with about five feet of block ice which had collected. No construction track and trestle could have withstood this.

Lack of a crane in the fall work was a hardship, but trucks and wagons were substituted and progress was not materially delayed. The first concrete was poured Sept. 7, and from that time on the mixers were kept almost constantly in operation until Jan. 11, when the piers and umbrellas from 5 to 11 inclusive were completed. If excavation had kept in the clear, pier 12 also would have been finished. Meanwhile, on account of the heavy fill at the west end of the structure, it was

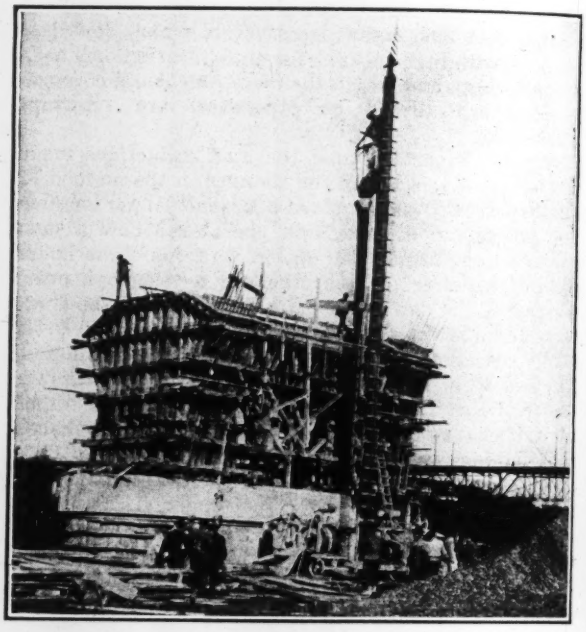


FIG. 2—PIER CONSTRUCTION WITH SKEWBACKS USING MAST HOIST

deemed advisable to get this abutment and the retaining walls built, and the major part of the fill made so as to take advantage of winter settlement. So this part was completed, also pier 2, by the middle of January, when it was necessary to suspend pouring until a more favorable season. About 4,600 of the total 12,000 cu.yd. of concrete had been placed.

A considerable part of this concrete was poured during very cold weather. The water and sand were heated by a steam plant so that the concrete was at a temperature of about 90 deg. F. when deposited in the forms. The concrete was then surrounded by canvas and steam pipes were used to prevent freezing. A maximum and minimum registering thermometer was used, as a part

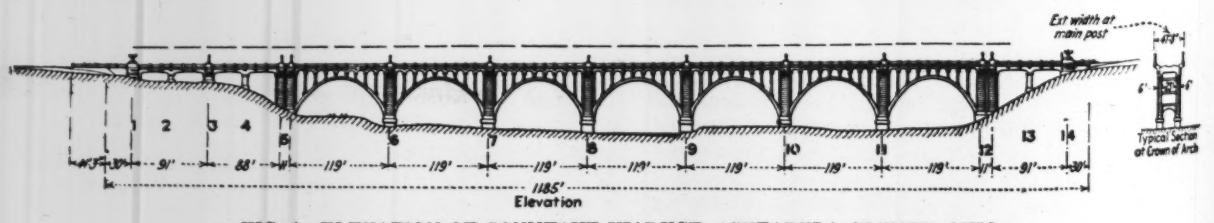

Ext width at main post
Typical Section at Crown of Arch
1 2 3 4 5 6 7 8 9 10 11 12 13 14
91' 88' 119' 119' 119' 119' 119' 119' 119' 91'
1185'
Elevation

FIG. 1—ELEVATION OF CONNEAUT VIADUCT, ASHTABULA COUNTY, OHIO

of the inspection, to get a record of night temperatures; none of the concrete was damaged in the least. Fig. 2 is a view of a pier under construction. The forms and mixers and the mast hoist described later are plainly indicated.

Erecting and Handling Centers—Early in the winter the arch-rib forms were laid out on a platform, using transit and tape. Three sets of these were built, the column pedestals being built as a part of the form for the extrados. During this season the carpenter shop also made up sectional forms for spandrel columns, pier shafts, floor beams and brackets.

As soon in the spring as the ice was gone, the crane track and timber trestle were built and preparations made to erect the steel centers for the arch ribs. These were furnished to the contractor ready for erection.

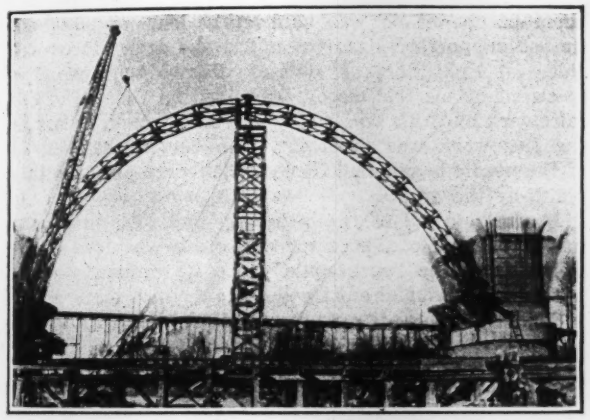


FIG. 3—ERECTING HALF CENTERS ON SUPPORT TOWER

Each center consisted of a pair of arch trusses with ties across the bottom to take the thrust. The truss was made up of a series of standard rectangular trussed sections, 3 ft. 3 in. in depth and 9 ft. 9 in. long. The sections at the heel of the truss and at the crown hinge were made special. The correct arch shape was secured by using beveled connections between the various sections. Six sets of these centers were used. This was more than was absolutely necessary, but considering the general usefulness of these standard truss sections later on, and the desire to get the ribs poured as early as possible, it was considered to be economy.

In Fig. 3 are shown the centers being erected at span 7-8. These centers were fabricated in halves on the ground. Timber bents of fixed dimensions were previously erected on the pier caps, and a timber tower was built up to support the crown end, at the center of the span. It was necessary to place this tower near the south side to enable the crane to land the truss. The first truss was then landed, the top end being supported on a pair of jacks resting on the tower. The second half was next raised into position and, co-ordinating the crane and jacks, the crown ends were brought together engaging the hinge. Wooden wedges were then inserted between the umbrellas and the heels of the truss, the jacks were relieved, and the centers were supported as an arch, being guyed laterally. The tower was then removed in sections and saved for the next span. Fig. 4 takes up the erection story where Fig. 3 left off. A different span, however, is shown. The horizontal ties are being erected. They consisted of a 6x6-in. angle for each leaf of the truss, supported at intervals by steel hangers. There is a turnbuckle at one end of each tie for adjustments. After these ties were bolted up, the steel center was rolled over to the north rib, using wooden rollers and a hand winch. This was accomplished in less than a half hour. When the center was in the correct position the rollers were replaced by triple wedges at each end.

Concreting Methods—In handling the concrete, perhaps the most interesting feature was the use of a portable plant made up of several small units. There were four mixers, each having a capacity of 7 cu.ft. When there was no urgent demand for yardage, the mixers were operated with a one-sack batch. When a larger output was needed, one and one-half-sack was used.

The concrete was hoisted by means of a mast consisting of a hollow rectangular timber column, faced on one side with a pair of steel angles, which reinforced it and at the same time afforded a metal surface on which a skip operated. The skip had a capacity of 8 cu.ft. These poles were built on the job, the angles, skip and dumping mechanism being purchased.

The pole was lengthened as construction progressed upward from pier umbrella to pier shaft or deck. In pouring the deck, a length of 110 ft. was required, the pole being guyed or braced at the top and at two immediate points. The skip discharged into short chutes or wheel carts, whichever means was being used to distribute the concrete into the forms. One pole was used to handle the output of two mixers. This guaranteed a full-time mix, for the hoisting time required determined the time interval between batches.

Fig. 5 shows the first rib being poured. The hoisting pole is much higher than the one in the view, Fig. 2. Each rib was poured in five sections, the sections adjacent to the spring being poured first, then the crown section. This constituted the first day's work on the rib. On the second day the two intermediate sections were poured. All pouring, of course, was symmetrical about the crown. On this rib, for information, the vertical displacement of the crown due to the weight of rib was measured. The total amount was about 1¾ in. As nearly as could be determined approximately ½ in. of this was due to settlement at the timber supports.

The concrete was mixed rather dry, calling for energetic spading. At certain times, due largely to inability to hold experienced labor at critical points, considerable honeycomb resulted, but in general the class of work has been above the average. One feature in particular which received special attention was the location and method of making construction joints. In the first place an effort was made to have the concrete as free from excess water as possible when approaching a horizontal plane on which a joint was to be made. In some of the thinner sections it would have been nearly impossible for a workman to remove laitance, for lack of room. Temporary finishing strips, where there was room to install them, were tacked onto the forms and the concrete carried up on these a small distance, so that when the strip was removed before resuming concreting, the joint then formed on the surface was horizontal and a straight line, not distinguishable from form marks.

Plant Selection Economies—To the engineer, the plant arrangement makes a strong appeal; first, because of thoroughness of mix, and second, because the whole operation of handling the materials, determining consistency, hoisting, placing and spading concrete was

carried on practically at one place, which allowed closer control with a smaller inspection force. On this job where there were many thin sections, heavily reinforced with steel, the placing and spading of concrete and seeing that all steel was properly held in place, were the principal problem of inspection, and to have the mixing done nearby made the engineer's problems somewhat easier.

At the time of beginning construction careful consideration was given to three types of plant which might

FIG. 4—PLACING TIERODS AFTER REMOVAL OF TOWER

be used: (1) A cableway for spanning the bridge, with a central mixing plant; (2) A concrete tower with intervening short towers and a system of spouting, together with a central mixing plant; (3) Insley type of mast hoists with smaller units of mixing plant which could be moved from one pier to another.

The last arrangement was adopted together with the installation of a crane track parallel to the bridge on one side with a 20-ton locomotive crane equipped with a 75-ft. boom. The reasons for adopting this type of plant rather than the first two types mentioned were as follows:

The first cost of a cableway was deemed unjustifiable for the yardage to be placed and considerable time would be required for the erection of this cableway and getting it into proper operation. Local conditions also made a cableway undesirable. Also it could not be used for handling any forms from underneath the completed structure. Furthermore, a central mixing plant would have been required underneath the bridge near pier 6, which would have interfered considerably with the erection of the falsework and forms for the pier shafts and deck, particularly at that point. The facilities for storing concrete material for a central mixing plant would also have required considerable rehandling of the materials.

A fixed tower and spouting plant was considered even less desirable than a cableway and furthermore no use could be made of this equipment other than placing concrete. The concrete work being spread over a length of about 1,300 ft. and operations going on at two or more places at the same time, a more flexible plant was deemed advantageous.

This contract was awarded in August, 1922, and operations were begun about Sept. 1. In order to take advantage of the probable good weather of the three fall months, it was decided to make use of the plant which could be erected quickly in order to complete, if possible, the piers 5 to 12 during that fall, so that the arch centering could be erected and other forms fabricated during the winter months. Another reason why small concrete mixers were preferable to one large mixer was that the concrete in a good portion of the work above the piers was in thin sections which would require great care in placing in order to obtain good results. With a large batch, as would have been required when handled by cableway, the concrete could not have been placed in the forms without rehandling.

Progress was dependent almost entirely on the speed of completion of the forms, and there was no difficulty whatever in placing concrete as fast at the carpenters could complete their work. The method of handling forms for the upper part of the work was a crane and a light derrick on top of completed deck supports. The boom of the crane was sufficiently long to place the timber supports and forms above the arch rib on one side. A light portable derrick of two tons capacity, operated by electric motor, was used on the top of the falsework and this was easily moved along on rollers as the falsework was erected. This derrick handled all of the needle beams and forms which were placed within reach by the crane.

In the removal of the centering and falsework from under the completed structure the crane was used almost entirely, as the boom could reach up underneath and swing this material out to the side.

The crane track was connected to the main siding and

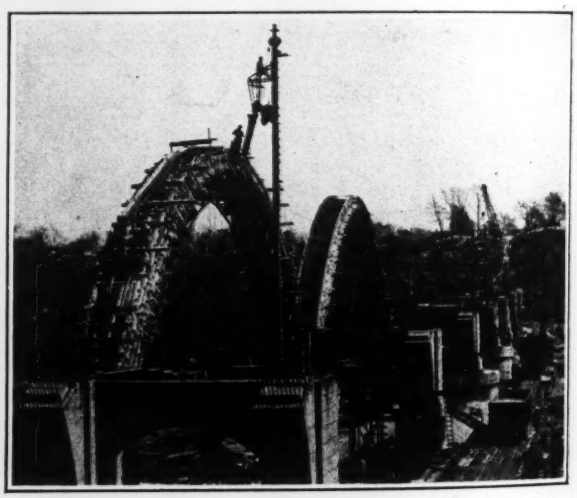


FIG. 5—CONCRETING ARCH RIB WITH MAST HOIST

about two-thirds of the concrete material was placed at intervals along this track as needed and there was not very much rehandling required. This gave a much larger space for storing this material, which was required, inasmuch as all of the sand and a great portion of the crushed stone were shipped to the job in the spring, 1923, and stored ready for use.

A carpenter shop was erected at one side of the structure and this was equipped with motor-driven saw tables and also a machine for threading rods required for the forms, and floor space was available for laying out form sections.

In regard to the greater number of laborers required to operate the concrete plant which was used rather

than a central mixing plant, it was found that it was necessary to have a considerable amount of labor on the job at all times in order to strip forms, handle material and do the work on the approaches to the bridge itself. The concrete took a portion of their time only, and this other work was carried on at the intervals between concreting periods.

C. L. Wilcox, secretary-treasurer of the Pitt Construction Co., a civil engineer of many years' experience, directed the work. J. P. Shobert was superintendent of construction. The engineering force consisted of J. R. Burkey with two full-time assistants. Many valued suggestions were received from Mr. Brown, the designing engineer and Messrs. Bixler & Legget, county surveyor and bridge engineer of Ashtabula County.

Butterfly Valve Dosing Control for Trickling Filters

Sliding Cam to Control Valve on Outlets to the Several Filter Dosing Areas and Give Better Distribution

By Henry R. King
Junior Engineer, Sanitary Division, Sanitary District of Chicago

IF SOME means could be devised for experimentally fixing the dosing of a filter after its construction and also for altering the dosing to take care of any changes needed in the distribution system after a period of operation, a filter efficiency might be obtained that would materially increase filter bed capacities. In this article the writer will suggest for trial a method for operating trickling filters so that a good distribution may be maintained and, if possible, filter bed capacities thereby increased.

If a filter bed should have several distribution systems each arranged for dosing equal but separate areas of the filter surface, each unit being controlled separately, the periods of discharge could be arranged so as to give an approximately uniform rate of flow to the filter bed when considered as a whole. The method of varying the rate at which sewage is dosed to a bed would be by varying the time allowed for rest and discharge periods in the dosing cycles. If during the discharge periods the pressure-time relation at the nozzles always remained the same, or in other words if the relative proportion of the time of the discharge periods allowed for each head on the nozzles remained fixed, the amount discharged during the dosing cycles would be proportional to the total time allowed for the discharge periods, and the relative amount of sewage falling upon each square foot of the filter surface would remain constant. If controls were provided for the distribution systems so that the time allowed for the discharge periods of the dosing cycles would vary with the rate of flow of the sewage (the pressure-time relation of the discharge periods remaining fixed) non-uniform flow could be taken care of and the quality of the distribution maintained.

Fig. 1 is an isometric drawing which the writer submits as a possible arrangement for a dosing control of trickling filters. It will be observed from the sketch that a butterfly valve is placed in each of the supply pipes of the several distribution systems. Pinions, attached to the stems of the valves, are geared to the uprights which move vertically in guides. Ball casters, attached to the lower ends of the uprights, roll on the surfaces of the conical cams below. The cams are all fastened onto the shaft which is revolved at a constant rate by means of the drive sprocket keyed to it. The drive sprocket is connected to the shaft in such a manner that the shaft may slide laterally through the sprocket hub. The cams (Fig. 2) consist of cylindrical blocks with depressions in them. The butterfly valves are closed when circular parts of the cylinders are under the uprights, but open when the uprights lower into the depressions of the revolving cams because of the weights above. These cams are shaped and attached to the shaft so as to give short discharge occurring in rotation for

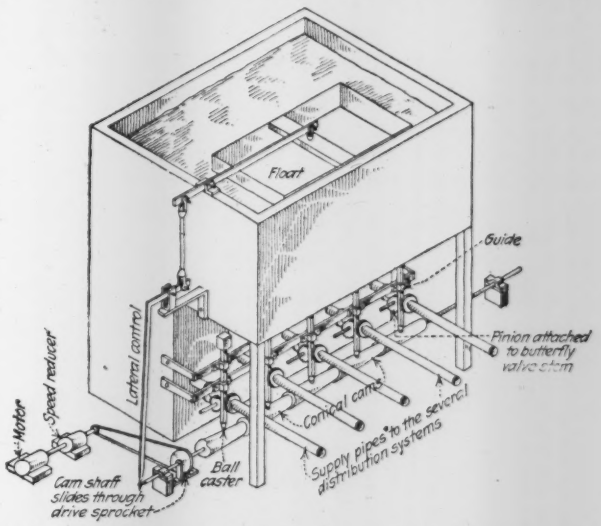


FIG. 1—SLIDING CAM CONTROL FOR TRICKLING FILTERS

the several distribution systems when their left ends are under the uprights. As the cams are shifted toward the left, longer discharge periods occur but the same relative distribution is maintained on the filter bed. The float is connected to the cam shaft through a system of levers. As this float is lowered or raised by a difference between the inflow and average outflow of the tank, the cams are shifted to the proper position so that the outflow equals the inflow. There should be enough play between the float and the shaft of the cams so that minor changes in the surface level of the sewage in the supply tank (occurring when the average rate of outflow equals a uniform rate of inflow) will not affect the lateral position of the cams.

When a tank is receiving sewage at a uniform rate and is discharging it into the distribution systems in rotation, a certain variation will occur in the total rate of discharge. This will result in a periodic rise and fall of the surface level, causing a small temporary storage in the tank. To illustrate how much this fluctuation storage might be the writer assumed a one-acre filter with circular spray nozzles spaced 14 ft. apart. The nozzles were assumed to discharge under a pressure-time relation in which the time from zero head to any head up to the maximum varied as the square of the head. The rate of discharge of a nozzle at the maximum head was considered to be 24 gal. per minute. It was assumed that the filter had five distribution systems of equal size operating, in rotation, 24 sec. apart on the same 2-min. dosing cycle. The variation of storage occurring at different uniform rates of flow was calculated for all rates between zero and the

maximum rate of dosing (5.9 m.g.d per acre) that could be obtained under the above assumptions. It was found that the greatest fluctuation storage likely to occur would be about 0.5 gal. per nozzle or about 128 gal. per acre of filter surface.

To keep the periodic fluctuation of the surface level of the sewage in the supply tank within 3-in. limits, the surface area of the tank for a one-acre filter bed would theoretically need to be about 70 sq.ft. This requires horizontal dimensions considerably smaller than are commonly used for dosing tanks. Still smaller tanks could be used for the same surface fluctuation if the time of the dosing cycles were reduced. The vertical sections of the supply tank could be of any convenient shape.

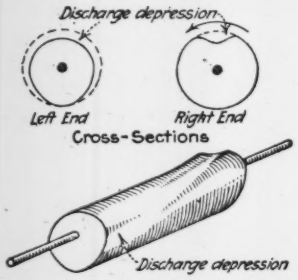


FIG. 2—DETAILS OF SLIDING CAM

Discharge depression shaped to give different length discharge periods (with the same pressure-time relation at the nozzles) for different lateral positions of the cam under the riser.

The most practical and effective method for obtaining proper dosing is to develop it experimentally at the trickling filter. A dosing tank cannot be easily altered and therefore does not serve as well for such a purpose. The cam-operated butterfly valve controls, in the author's opinion, present an easy and inexpensive method of obtaining a uniform distribution after the filter has been constructed.

For example, suppose that a filter has a control similar to that of Fig. 1. The entire plant could be built with the exception of the cams which may be designed from experimental data obtained at the plant. To obtain the necessary data for the design of the cams, pressure gages should be connected to each of the several distribution systems near the nozzles. The pressures at the nozzles and the corresponding positions of the uprights should be recorded while sewage is flowing from the tank, for a number of different pressures within the allowable nozzle pressure range. Having determined by experiment the actual relation of the positions of the uprights to the pressures at the nozzles, and the distributions occurring on the filter at different fixed nozzle pressures, it is a comparatively simple matter to design the cams so as to give the proper pressure-time relation at the nozzles. During such tests the surface level of the sewage in the supply tank should be maintained at the elevation which will occur in actual operation. If this procedure were followed it would not be necessary to rate the butterfly valves before designing the cams, and the distribution resulting in operation should be very good.

The writer suggests this method of filter control for experiment inasmuch as he has never tried it in an actual plant. He believes such trial under adequate laboratory control may establish the fact that trickling filters, cam-controlled in the manner presented, offer an improvement in the sewage distribution over the filter surfaces. Such an improvement might result in some increase in the allowable population loading per acre of filter. This increase in filtration coupled with the centralization of plant control in one building, is the possible economic advantage that may be derived from the development of cam-controlled trickling filters.

Tests Show How Damp-Sand Curing Improves Quality of Concrete

Effect of Oil on Pavements Shown by Tests on Small Blocks—Impermeability Depends Largely on Method of Curing

BY F. D. CROOK and HERBERT FAULKNER
Engineer of Tests and Assistant Engineer of Tests, respectively, City Engineer's Office, Seattle, Wash.

INVESTIGATIONS in many laboratories have shown conclusively that both the strength and resistance to wear of concrete cured in a damp condition are 100 per cent or more greater than those of concrete cured in air. These results are generally known. Certain other aspects of curing, exemplified by these tests, are not so generally known but have an important bearing on producing good concrete, and justify the publication of the following data.

The investigations which brought out these data

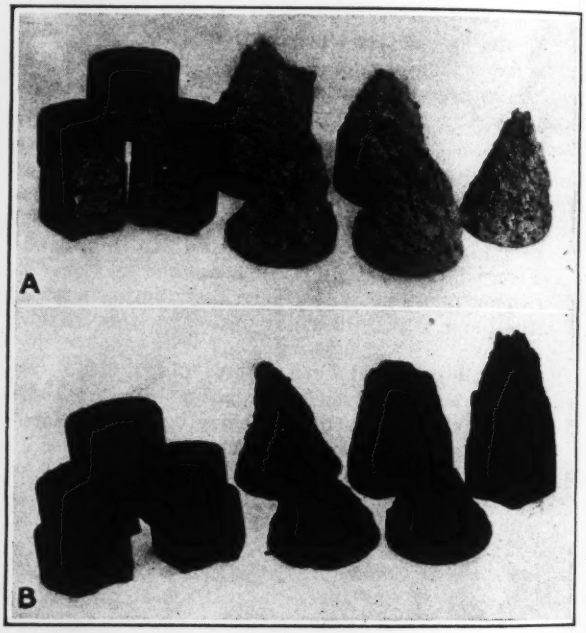


FIG. 1—EFFECT OF OIL ON CONCRETE CURED UNDER DIFFERENT CONDITIONS

Series *A* cured in air but not exposed to sun or wind. Series *B* cured in damp sand.

originated in an effort to determine the cause of trouble in a heavily traveled concrete road built in the late fall of 1919 and now showing appreciable surface wear which is greatest along that portion of the pavement where drippings of oil from the crank-cases of automobiles have been heaviest. At the time this pavement was constructed it was not regarded as necessary to provide especial means of curing in the winter months, the frequent rains and cloudy weather being considered sufficient in this respect. However a considerable section of the pavement in question did not secure the expected rain and cloudy weather and it is this portion that is not standard.

To ascertain if oil drippings had a deleterious action, companion sets of briquettes and 2x4-in. cylinders were made from a batch of 1:2 concrete mortar. Specimens

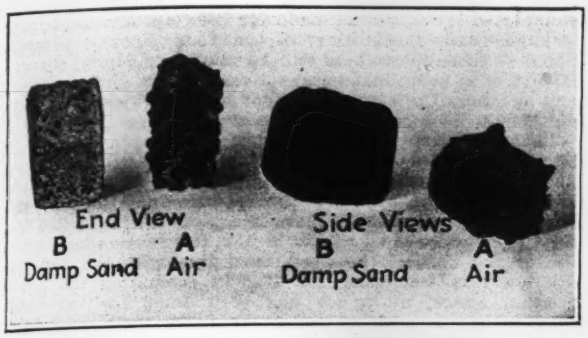


FIG. 2—EFFECT OF ACID ON CONCRETE CURED UNDER DIFFERENT CONDITIONS
Block *A* cured in damp sand. Block *B* cured in air.

of series *A* were cured in the air of a basement room for 28 days without exposure to sun or wind. Specimens of series *B* were cured in damp sand for 28 days. Both sets were then immersed in crank-case oil for various periods of time. The strength-time values up to the age of one year are shown in Fig. 3.

Fig. 1 shows the interesting contrast between corresponding fragments of briquettes and cylinders of both series at the age of one year. It will be observed from this figure and the strength-time diagram that the air-cured specimens of series *A* were completely saturated by the oil and possessed low compressive strength whereas the damp-sand-cured specimens, series *B*, showed only the slightest surface penetration and possessed high compressive strength. Since the strength of series *B* specimens was slightly better than that of specimens cured continuously in damp sand, the conclusion that oil-drippings were harmless to well-made concrete was inescapable.

Acid Test—The following is an average of several tests: two equal-sized pieces of broken briquettes, aged 28 days and cured in air and damp sand respectively, were immersed for four days in a 10 per cent solution of hydrochloric acid. Fig. 2 shows the results. The air-cured specimen has been reduced by the acid to one-half its original weight; the damp-sand-cured specimen shows only a slight surface attack.

Permeability Test—Small slabs 6x6x2 in. were made of 1:2:4 concrete with ½ in. maximum size aggregate.

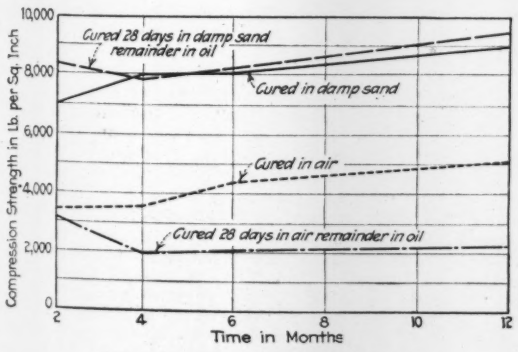


FIG. 3—STRENGTH-TIME CURVE
Showing effect of oil on improperly cured concrete

These slabs were cured for 28 days under three methods as follows: (1) Air, laboratory temperature about 62 deg. F., (2) sprinkled for 10 days and then air cured for 18 days; (3) covered with damp sand and kept moist for 28 days.

All the slabs were subjected to a permeability test under a pressure of 50 to 100 lb. per square inch by forcing water under the desired head against one surface of the block. Rubber gaskets confined the water to the center of the specimen, which was held in a cast-iron form by four bolts during the test as shown in Fig. 4. (1) The slab cured in air showed moisture through the concrete under a pressure of 50 lb. per square inch in 7 minutes and a subsequent flow of 38 c.c. of water per hour. (2) The slabs cured by sprinkling showed moisture through the concrete under a pressure of 50 lb. per square inch in 53 minutes and developed a flow of 4 c.c. of water per hour. (3) The slabs cured in damp sand showed no moisture through the concrete after being subjected to 100 lb. pressure per square inch for 24 hours, which is equivalent to a head of 232 ft. of water.

Abrasion Test—Pieces of broken briquettes of equal age—air-cured and damp-sand-cured—were polished on

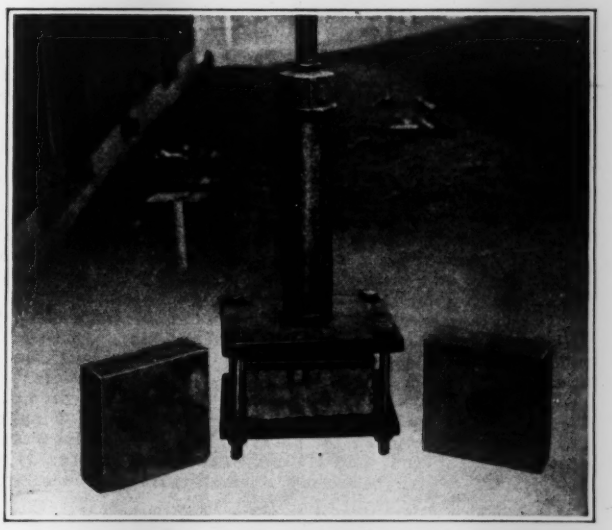


FIG. 4—DEVICE FOR TESTING PERMEABILITY OF CONCRETE

an emery wheel. It was impossible with the air-cured specimens to secure aught but the most rough and irregular surface, the particles of coarse aggregate being torn out of the matrix. On the other hand the damp-sand-cured pieces polished in a remarkable manner and intersecting surfaces could be ground to a clean sharp edge.

The results of these tests but emphasize and reiterate the value of curing in making good concrete, whether it be for hydraulic structures, roads, sewer pipe and drain tile, or marine works. Impermeability is a desideratum in concrete for all of these uses and depends upon the curing, regardless of the richness of the mix or grading of the aggregate. Hydration or crystallization of the cement can occur only in the presence of moisture and cannot proceed when moisture is absent. This hydration or crystallization involves the formation of crystals, which in expanding fill the voids and in interlocking give increased strength. The value of supplying the required moisture is manifested by the above tests as well as by hundreds of others.

Costs of Water Supply Mains of Four Different Materials

Estimates for Long Lines and Large Sizes of Cast-Iron, Steel, Concrete and Wood-Stave Pipe

By Dabney H. Maury
Consulting Engineer, Chicago

Abstract of a paper and discussion before the American Water Works Association, New York City, May, 1924.

CONSPICUOUS examples of American cities which have gone far afield for water are Los Angeles, which brought in a new supply from 235 miles away; San Francisco, 154 miles; New York, 120; Tulsa, Okla., 60; Phoenix, Ariz., 32; Butte, Mont., 27; Denver, 25; and Norfolk and Portsmouth, Va., about 20 miles each. In Canada the city of Winnipeg brought in a new supply a total distance of 98 miles, while Victoria went 38 miles for its water. In Australia, the Coolgardie pipe line is 351 miles in length. In Southern Italy, the Apulian aqueduct built to supply 266 communities will have 152 miles of the main trunk conduit and 841 miles of main and subsidiary branches leading therefrom. Many other instances could be cited, and their number is increasing rapidly. At least one other pipe line more than 100 miles in length is already under contemplation in this country. Enough has been said to show that the near future will see a very large amount of capital invested in supply mains, and that the economic design of these mains is a live and important problem.

It will be the purpose of this paper to describe in detail the principal types of pipe available for large supply mains, to present approximate estimates of their respective first costs for various diameters and pressures, to set forth their respective advantages and disadvantages, and to endeavor to put a financial value on these advantages and disadvantages, to the end that the several pipes may ultimately be compared on a dollar-and-cent basis.

[The author then summarized the historical and technical developments of cast-iron, steel, concrete and wood-stave pipe; set forth certain conditions common to all four; and presented somewhat detailed cost estimates by materials, size and head. Next the main figures were brought together for comparison (Table I and diagrams). Finally adjustments were made for carrying capacity, leakage and durability (Tables II and III and explanatory matter). It is feasible to give here only a small part of the entire paper—Editor.]

First Cost—The estimates of first cost herein presented are approximate only, as they are necessarily based on certain assumed conditions which might not obtain in any given case. They are limited to one type of pipe in each of the four materials, this being done not with the intention of indicating a preference for the types considered, but because the time required for estimates on every available type would be out of all proportion to the value of the estimates.

The precast concrete pipe discussed is patented; but it is believed that there are patents on one or more details, either of design or manufacture, in the case of practically every other pipe considered. In any event, competition between a number of available types could be secured by a properly worded advertisement of the letting.

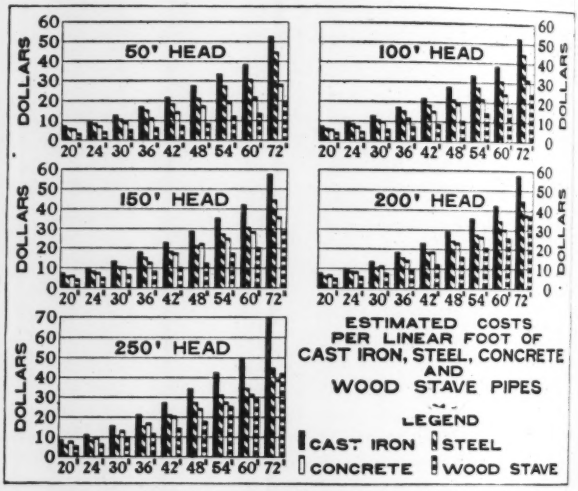
In each of the estimates deliveries of material are supposed to be f.o.b. cars with Chicago freight allowed. Prices of materials are those of Jan. 1, 1924, and common labor is taken at 50c. an hour. Trenches are assumed to have a clear width 2 ft. greater than the outside diameter of the pipe, and to be deep enough to provide 2 ft. of cover. In each case the length of the line is assumed to be 25 miles, and the average haul from cars to trench is assumed to be half of this length, or 12½ miles. Where the weight of a single pipe is less than three tons, the hauling is assumed to be done by truck. For pipe of greater weight, the cost of constructing and operating a temporary railroad is included in the item of hauling. Each item includes contractor's profit.

Financial Comparison—There will now be illustrated by an example one method by which allowances, reduced to dollars and cents, can be made for the respective capacities, leakages and durabilities of the four pipes considered. Some of these allowances will be related to capital charges involving in some instances, the cost of the entire project, and in others the cost of portions of the project; and some of them will be related to operating expenses only.

Let us assume that the length of our conduit will be 25 miles, or 132,000 ft.; that its diameter will be 54 in.; and that it must be capable of delivering 50 m.g.d. at its lower end. With $c = 100$ for cast-iron and steel pipe, the friction loss for each of these two pipes would be 256 ft.; for the concrete pipe, with $c = 130$, the friction loss would be 157 ft.; and for the wood-stave pipe, with $c = 115$, the friction loss would be 199 ft. In computing the above friction losses, allowance has been made for the small friction loss caused by the water which would leak from each pipe on the way down.

It is next assumed that if the line be either cast-iron or steel, the average head on it would be 150 ft.; if concrete, 100 ft.; and if wood stave, 122 ft. The difference between these heads for any two pipes is equal to half the difference between the friction losses for the same two pipes.

It is assumed that there will be a dam to form an impounding reservoir at the upper end of the line, and a steam



COSTS OF WATER MAINS OF FOUR MATERIALS

pumping station taking water from the reservoir and forcing it through the pipe. The cost of the dam and pumping station building and immediate piping connections is assumed at $1,800,000 in the case of each of the four pipe lines; and the cost of the pumps and boilers required is roughly estimated at $275,000 for either the cast-iron or steel pipe, $200,000 for the concrete pipe and $235,000 for the wood-stave pipe, the differences in the cost of the pumping equipment being due entirely to the differences in the pumping heads.

If the average head on the cast-iron, steel and wood-stave pipes were 100 ft., as in the case of the concrete pipe, it will be seen from Table I that the first cost of the cast-iron pipe would be $33.57, of the steel pipe $27.58, of the concrete pipe $21.88, and of the wood-stave pipe $14.82. But the differences in average head increase the cost of cast-iron pipe by $2.18, bringing it up to $35.75, while the cost of the steel pipe is not increased, as the thickness assumed for 100-ft. head is sufficient for 150-ft. head. The cost of the concrete pipe remains at $21.88, which corresponds to a head of 100 ft. The cost of the wood-stave pipe, which is designed for an average head of 122 ft., is found by interpolation to be $16.10, showing an increase of $1.28.

The total actual investment in each case, including an allowance of 50c. per linear foot for right-of-way, is summarized in Table II, which, it must be noted, gives actual costs. The pumping equipment required in the case of the cast-iron and steel pipes costs $75,000 more than that required for the concrete pipe, and the pumping equipment for the wood-stave pipe costs $35,000 more than that for the concrete pipe. To allow for these differences, we should

have to charge the cast-iron and steel pipe each with an added cost of 57c. per linear foot, and the wood-stave pipe with an added cost of 27c. per linear foot, in order to compare them with concrete pipe, on the basis of cost of pumping equipment.

The operating expense for labor would be the same in all four cases; but assuming an average pumpage of 30 m.g.d., the annual fuel cost at $5 per ton for coal is estimated at $46,166 per year for cast-iron or for steel; $28,313 for concrete, and $35,887 for wood-stave. The difference between the fuel cost for either the cast-iron or steel pipes and for the concrete pipe would be $17,853, which amount capitalized at 6 per cent would produce $297,550. Similarly, the difference between the fuel costs for the wood-stave pipe and for concrete pipe would be $7,574 which, capitalized at 6 per cent, would be $126,233. We should therefore charge the cast-iron and steel pipes with $297,550 each, and the wood-stave pipe with $126,233, in order to allow for the greater carrying capacity of the concrete pipe. These charges would amount to $2.25 per linear foot each in the case of the cast-iron and steel pipes, and to $0.96 per linear foot in the case of the wood-stave pipe.

TABLE I—SUMMARY OF COSTS PER LINEAR FOOT

Size, In.	50-Ft. Head C.-I.	Steel	Conc.	W.-S.	100-Ft. Head C.-I.	Steel	Conc.	W.-S.
20	$7.04	$6.00	$5.53	$3.46	$7.04	$6.09	$5.69	$3.96
24	9.23	8.62	7.05	4.13	9.23	8.62	7.28	4.73
30	12.91	10.86	9.27	5.11	12.91	10.86	9.84	5.96
36	17.08	15.48	11.33	6.12	17.08	15.48	11.89	7.27
42	21.87	18.56	14.59	7.36	21.87	18.56	15.57	8.90
48	27.89	21.33	17.58	8.53	27.89	21.33	19.27	10.52
54	33.57	27.58	19.71	12.14	33.57	27.58	21.88	14.82
60	38.38	30.95	21.94	13.77	38.38	30.95	24.48	17.02
72	52.66	44.74	28.30	19.14	52.66	44.74	31.68	24.08

Size, In.	150-Ft. Head C.-I.	Steel	Conc.	W.-S.	200-Ft. Head C.-I.	Steel	Conc.	W.-S
20	$7.48	$6.00	$6.27	$4.48	$7.48	$6.00	$6.66	$5.03
24	9.68	8.62	7.84	5.38	9.68	8.62	8.35	6.03
30	13.49	10.8[illegible]	10.63	6.84	13.49	10.86	11.19	7.77
36	18.08	15.4[illegible]	13.02	8.47	18.08	15.48	14.14	9.74
42	23.02	18.56	17.81	10.46	23.02	18.56	18.62	12.05
48	28.98	21.33	22.54	12.58	28.98	24.43	23.22	15.94
54	35.75	27.58	25.34	17.73	35.75	27.58	26.43	20.61
60	42.08	30.95	28.70	20.42	42.08	34.60	30.12	25.62
72	57.86	44.74	36.19	29.03	57.86	44.74	37.59	37.29

Size, In.	250-Ft. Head C.-I.	Steel	Conc.	W.-S.
20	$8.65	$6.00	$8.03	$5.60
24	11.27	8.62	9.95	6.61
30	15.84	10.86	13.46	9.76
36	21.21	15.48	17.16	11.90
42	27.20	21.15	20.57	14.63
48	34.44	27.42	24.35	17.96
54	42.60	31.18	27.70	25.38
60	49.90	34.60	31.52	29.07
72	69.90	44.74	39.01	42.11

We have assumed that the cast-iron, steel and concrete pipes would each leak at the rate of 100 gal. in 24 hours per inch of diameter per mile of pipe, and that the leakage in the wood-stave line would be 350 gal. per inch-mile, so that the wood-stave pipe should be charged with the value of 250 gal. per inch-mile, in order to put it on the same footing with regard to leakage as the other three pipes. This amounts to 337,500 gal. per day, which is 0.675 per cent of the total net capacity of the line.

The cost of the entire project, assuming that wood-stave pipe be used, would be $4,226,200, and applying the percentage just found, we have $28,527 as the capital charge against the wood-stave pipe, on account of its greater leakage. This corresponds to 22c. per linear foot.

We must next charge the wood-stave line with the capitalized cost of pumping 337,500 gal. of water which would never reach the lower end of the pipe line. Estimating this at 0.75c. per 1,000 gal., the annual cost of pumping 337,500 gal. per day would be $924, which capitalized at 6 per cent, would equal $15,400, which is equivalent to 12c. per linear foot.

We must next allow for the respective durabilities of the four pipes. The actual costs per linear foot of the four pipes would, as already stated, be $35.75 for the cast-iron, $27.58 for steel, $21.88 for concrete, and $16.10 for wood-stave. Having assumed the life of cast iron at 100 years, and that of steel and concrete each at 70 years, it would be necessary to charge each of the two last-named pipes with three-sevenths of a renewal, 70 years from date, to put it on a comparable basis with cast iron. The present worth of three-sevenths of $27.58, payable 70 years hence, is $0.76, which must be added to the cost of the steel pipe in order to allow for the greater durability of cast-iron pipe. The present worth of three-sevenths of $21.88, payable 70 years hence is $0.60, and this sum should, for the same reason, be charged against the concrete pipe. The life of wood-stave pipe has been assumed at 40 years, and this pipe would require one renewal 40 years from now, and one-half of a renewal 80 years from now. The present worth of $16.10, payable 40 years hence is $3.35; and the present worth of one-half of $16.10, payable 80 years hence, is $0.35; and these two amounts must be charged against wood stave pipe to put it on a comparable basis with cast iron as to durability.

In Table III all of the foregoing allowances are set forth under the respective actual costs per linear foot, in order to arrive at the respective equivaluated costs.

Discussion: President Fuller said there is always a question of local suitability and reliability in connection with the choice of material for a pipe line that cannot be expressed in dollars and cents. Nicholas S. Hill remarked that the paper by Mr. Maury leads away from the common thought of water-works men that cast iron is the only kind of material available for pipe lines. When cast-iron pipe costs from $22 to $28 a ton, consideration of the possibility of some other material did not so much matter as it does now when it costs $60 or more. The question of carrying capacity is very important in long lines. Mr. Maury said he was not sure that the day is not coming when cast-iron pipe will be lined with cement mortar, even pipe for distribution systems.

At this point President Fuller announced that there was in attendance at the convention a member of the association from Australia, Edgar G. Ritchie, engineer of water supply, Metropolitan Board of Works, Melbourne. In response, Mr. Ritchie said he had had considerable experience with various classes of pipe, particularly wrought iron and steel, mostly the latter, and that contracts had recently been let for 19 miles of 45 to 56-in. electrically welded steel pipe. After having used wrought iron pipe for some time riveted steel pipe was adopted. In 1912 the use of lock bar steel pipe was begun and now a change is being made to electrically welded. Mr. Ritchie raised the question, When is a steel pipe worn out? He said that under his direction steel pipe that was beginning to cost too much for maintenance had been taken up, repaired, recoated, and relaid elsewhere, with only a very small percentage of loss in length. By this means the useful life of steel pipe has been extended much longer than was expected when the pipe was first laid.

Charles B. Burdick, consulting engineer, Chicago, remarked that while cast-iron, steel and wood pipe have been used long enough to prove themselves a longer period is needed to throw light on some phases of the use of concrete pipe. At Gary, Ind., well protected steel pipe has proved satisfactory after a number of years' use, extending even to pipe in the distribution system down to 6 in. in diameter.

TABLE II—ACTUAL COSTS OF VARIOUS ELEMENTS OF SUPPLY WORKS FOR EACH OF FOUR KINDS OF PIPE

	Cast-Iron	Steel	Concrete	Wood-Stave
Dam, pumping station, piping connections and real estate	1,800,000	1,800,000	1,800,000	1,800,000
Pumping equipment	275,000	275,000	200,000	235,000
Pipe line	4,719,000	3,640,560	2,888,160	2,125,200
Right-of-way	66,000	66,000	66,000	66,000
Total	6,860,000	5,781,560	4,954,160	4,226,200

William Gore, consulting engineer, Toronto, said his experience has been that coating is still much of a problem, especially coating of steel pipe. He believed that most of the trouble experienced on the Coolgardie pipe line, Australia, was due to defective coating. Pipe from that conduit sent to England had no coating left. On some recent work, Mr. Gore was unable to get coated pipe, so painted pipe was used instead. The paint was off before the pipe was well on the job. Mr. Gore has decided to make designs for a steel pipe line and then ask for bids on concrete as well.

W. W. Brush, engineer, Department of Water Supply, New York City, said he was much ashamed to think that engineers are accepting such coating of cast-iron pipe as is now being done. He remarked further that he was a member of a committee before which one of the chief questions for some years past had been pipe coating and that practically no progress is being made on that subject. He was not sure that he was justified in continuing to use

cast iron as a material for large pipe. In New York, breaks in cast-iron pipe do much damage especially when they result in the flooding of subways and basements. Steel will not break as does cast iron. New York City has a number of steel lines in use, the oldest of which was put down in 1896. None has given trouble. Col. Leonard P. Wood, an engineer of the Board of Water Supply, New York City, said that in the last ten years the board had laid much large steel pipe, ranging in size from Catskill Aqueduct siphons as large as 11¼ ft. in diameter downward. These siphons had been lined inside with cement mortar and protected on the outside with concrete. So far as known, all these siphons are in good condition. The other lines had been laid in city streets. One now under construction is 72 in. in diameter. Bitumastic enamel coating is now being used.

James L. Gibson, chief engineer, water-works, Charleston, S. C., said he thought that all water-works engineers and superintendents are having trouble with the incrustation of cast-iron pipe. To his mind the only thing to do is to use cement lining inside and out, as has been the practice lately at Charleston.

Mr. Ritchie, of Australia, referring to the remarks by Mr. Gore on the Coolgardie pipe line, remarked that the coating on that line never had a fair chance. It was exposed in transit and also by lying out in the hot sun, some of it for two years before the pipe was laid. Coating should be varied in factories to suit seasonal exposure. Mr. Ritchie said he shared the feeling expressed by Mr. Brush as to the unsatisfactory coating of cast-iron pipe. He had been disappointed in finding that America is not doing much better than Australia in this respect. Thomas H. Wiggin, consulting engineer, New York City, spoke favorably of experience with cement-lined concrete protected steel siphons and other steel pipe in connection with the Catskill Aqueduct supply. It had been assumed that a value of c of 120 would be given by these pipes. Tests had shown values to be as high as 160 with an average perhaps of 150. Consequently in adding lines 4 and 5 to the siphons, they have been made some 6 in. smaller.

Theodore Leisen, manager of the Omaha water-works, who was temporarily in the chair, said he wondered if any of the manufacturers wanted to come forward and make an apology for pipe coating. There was no response. Mr. Leisen then added that he had the same feeling on coating as Mr. Brush had expressed.

Mr. Maury, in closing the discussion, said the one prime object of the paper had been accomplished, namely, to set people thinking.

TABLE III—COMPARATIVE COSTS PER LINEAR FOOT OF FOUR KINDS OF PIPE AFTER FINAL ADJUSTMENTS

	Cast-Iron	Steel	Concrete	Wood-Stave
Actual first cost	$35.75	$27.58	$21.88	$16.10
Capacity allowances for cost of pumping equipment	.37	.57	.00	.27
Capacity allowances for cost of pumping	2.25	2.25	.00	.96
Leakage allowances, based on total investment	.00	.00	.00	.22
Leakage allowances, based on cost of pumping the leakage	.00	.00	.00	.12
Allowances for durability	.00	.76	.60	3.70
Total equivaluated costs	38.57	31.16	22.48	21.37

Standard Oil Co. Removes Signboards

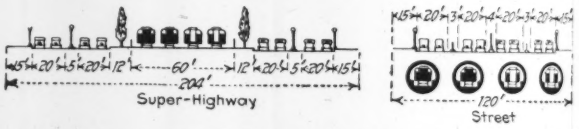
Approximately 1,200 signboards that have been erected and maintained by the Standard Oil Co. are being removed from the highways of California, Oregon, Washington, Nevada and Arizona. The company announced recently that it believed such signs detracted from the natural beauty of the travel routes on the Pacific Coast, and because it felt that the scenery should be unmarred it would remove its existing signboards and would erect no others in the future. The advertising value of the signs and the investment represented would be willingly sacrificed, it was stated, in the interest of making the highways more attractive. Hereafter the company will place signs only in commercial locations.

Super-Highway System Proposed for Detroit

Wide Radial Highways in Suburban Area—Provision for Rapid Transit Line and Fast Motor Traffic in the Future

IN ANTICIPATION of the need for wide streets and rapid transit routes in the suburban area now surrounding the city of Detroit as the city spreads out to occupy this area in future years the Rapid Transit Commission of Detroit has proposed what it terms a super-highway plan for Greater Detroit. The basic idea of the plan is that, while land values in the suburban area are low, the city shall acquire rights-of-way for a number of wide streets which in the future can be used for four lines of rapid transit, two roadways for fast motor traffic, and two for slow-moving traffic.

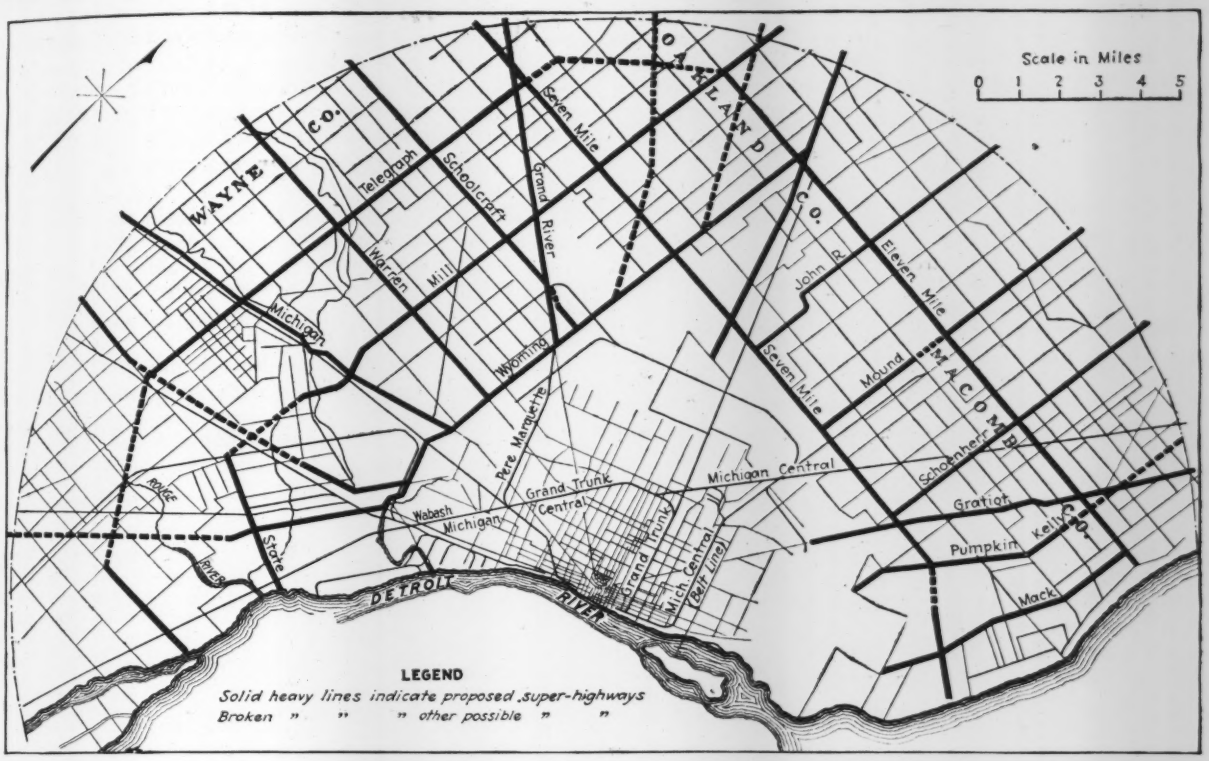
The proposed super-highway system deals with the area between the 6-mile and 15-mile circles from the center of the present city. Consequently it not only is a matter of concern for the present city of Detroit, but also for the counties of Wayne, Oakland, and Macomb, and a number of independent municipalities adjacent to and surrounding Detroit that ultimately will be included in Greater Detroit. Within the city proper little can be done towards providing wider streets for motor traffic because the area is already built up and street widening will require the acquisition of costly property. This is the reason why the Transit Commission has, at this early date, put forward this plan for the acquisition of additional right-of-way along existing streets and right-of-way for new streets in the sparsely settled areas before property values go up.



SECTIONS THROUGH STREET AND SUPER-HIGHWAY

An advantage of this plan lies in the fact that besides providing a right-of-way for wide streets it also provides space for rapid transit lines in the center of these new highways, which lines can be built at grade when they are required, thus avoiding the necessity of building either subways or elevated railways. The cost of such rapid transit lines at grade is estimated at $1,100,000 per mile as against $5,500,000 for similar four-track subways. Consequently 5 miles of surface rapid transit can be built for the same money that would be required for 1 mile of subway if the new streets did not provide this space for rapid transit lines. Of course, within the city proper, rapid transit lines will have to be built as subways under existing streets. The plan recognizes this fact and provides for the transition from 120-ft. streets with four-track subways to the 204-ft. super-highway near the outskirts of the present city, as shown in the accompanying drawing.

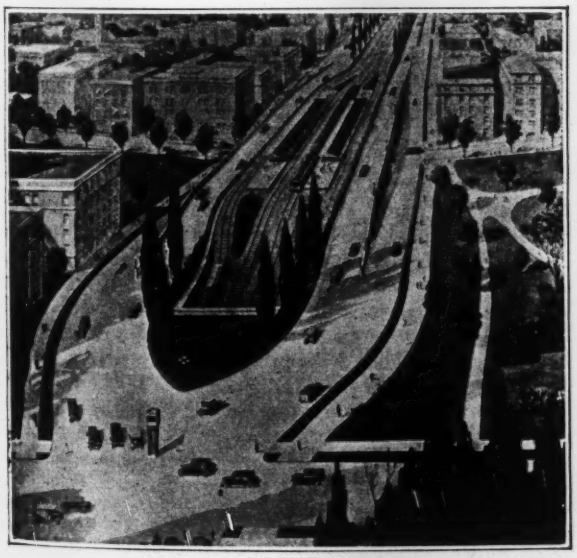
The plan does not call for building any or all of the super-highway as a complete unit at the start because it is recognized that the full width of highway will not be required except as the suburban area develops, and that two-track rapid transit lines will serve adequately until the city passes the 10-mile limit. When this point has been reached, the two additional tracks for express



CITY OF DETROIT, SHOWING LOCATION OF PROPOSED SUPER-HIGHWAY

service can be added in the space reserved for that purpose and possibly the inner roadways for fast motor traffic will be added at the same time.

The provision for the fast motor traffic is one of the special features of the plan. These roadways will be so arranged on the radial highways that there will be no cross traffic to interfere with or delay cars running on them. This separation of the through from the cross traffic will be accomplished by elevating the two motor speedways as well as the four rapid transit tracks above the cross streets at ½-mile intervals. This arrangement is best shown in the accompanying perspective drawing. Crosstown traffic will pass under the motor and rapid transit lines through archways which will also provide for access to the rapid transit stations. Thus foot passengers will not be required to cross the motor speedway.



PROPOSED SUPER-HIGHWAY SHOWING TRANSITION FROM 204-FT. HIGHWAY TO 120-FT. STREET

The super-highway district is generally divided into areas approximately 3 miles square, or of about 9 sq.mi., bounded on all four sides by super-highways. The super-highway system does not include the thoroughfares through the subdivisions of these areas surrounded by the super-highways themselves, but the plan considers it desirable that the intermediate section line roads located on the mile divisions should be made 120 ft. wide and the half-mile streets should be 86 ft. wide. If the mile streets are given a width of 120 ft., then it will be practicable, if traffic conditions warrant, to convert them into express motor traffic streets by elevating the express lanes over the half-mile cross streets as will be done in the case of the super-highways.

The super-highway plan was prepared for the Detroit Rapid Transit Commission by Daniel L. Turner, consulting engineer, and John G. Hallihan, engineer in charge.

Gasoline Declared a Necessity of Life

The Massachusetts Legislature at its recent session declared gasoline a necessity of life. This was done in order to make it possible for the Special Commission on Necessaries of Life, previously created by the Legislature, to investigate the gasoline industry.

Determination of Internal Leakage In Centrifugal Pumps

Research in Hydraulic Laboratory of University of Michigan Establishes Facts Regarding Coefficient of Discharge

By A. F. Sherzer
Associate Professor of Mechanical Engineering, University of Michigan, Ann Arbor

IN CONNECTION with the development of designs for high-head single-stage centrifugal pumps the writer found it necessary to determine with considerable accuracy the probable amount of internal leakage that might be expected under various conditions. The results of this work have established quite definitely: (1) That the coefficient of discharge is not constant; (2) that the coefficient of discharge varies with the head causing flow; (3) that the coefficient of discharge varies with the radial clearance; (4) that it is nearly independent of the width of the clearance rings.

Those familiar with the centrifugal pump will recall that in order to prevent the high-pressure water from short-circuiting back into the suction of the impeller it is necessary to have the neck of the impeller revolve with exceedingly small clearance between it and the stationary casing. This clearance is usually but a few thousandths of an inch but nevertheless permits the leakage of a considerable amount of water at times. This internal leakage naturally consumes power and, worse yet, reduces the capacity and efficiency of the pump. The importance of this varies about as the specific speed; that is, in large-capacity low-head pumps, which are of high specific speed, its effect may be negligible while in low-capacity, high-head pumps which are of low specific speed, the leakage is of the greatest importance. In the latter case the leakage may often amount to a relatively large per cent of the pump's capacity.

A thorough search of all available literature was made to obtain data from which this leakage might be computed. Only a few references were of any value at all and these unfortunately in most cases dismissed the subject with the remark that the leakage would vary from 3 to 5 per cent and should be allowed for accordingly in the design. Some attempt was made to estimate the leakage by considering the flow as through an orifice using a coefficient of discharge of 50 per cent and the head as the total head against which the pump was working. This method required two very arbitrary assumptions, one of which appeared to be absolutely incorrect and hence did not seem at all suitable for any pretension to accuracy.

To secure accurate information on this leakage the writer laid out a program of experimental investigations which were conducted in the Hydraulic Laboratory of the University of Michigan by some of the advanced students specializing in hydraulic machinery. The results were of the greatest interest as they established quite definitely several facts not generally known and even contrary to general beliefs. Such conclusions as are reached should prove valuable not only in the centrifugal pump field but in general hydraulics as well, since the subject is essentially that of the flow through a very special and unusual type of orifice.

The flow through an orifice may be computed in the usual manner from the formula $Q = CAV$, where Q is the discharge, A is the area of the orifice, V the velocity of flow, and C is a coefficient which considers the effect of friction, contraction, etc. In the case where the velocity V is produced by the fluid acting under a head of H feet we may say that the velocity $V = \sqrt{2gH}$. This may be introduced into the formula and we have $Q = CA\sqrt{2gH}$. In an ideal case with no friction or contraction we would have $Q' = A\sqrt{2gH}$. If we divide the actual Q by the ideal Q' we obtain the value of C which we call the coefficient of the orifice. In the case of a sharp edged orifice C is about 60 per cent. This no doubt accounts for the value of 50 per cent assumed in one of the articles investigated.

The nature of the problem is rather simple and at once suggests its division into two parts: (1) The determination of the pressure difference causing the flow through the clearance; (2) actual measurement of the leakage through the clearance under a known pressure difference in order to determine the coefficient of discharge C. These investigations were taken up in the order given.

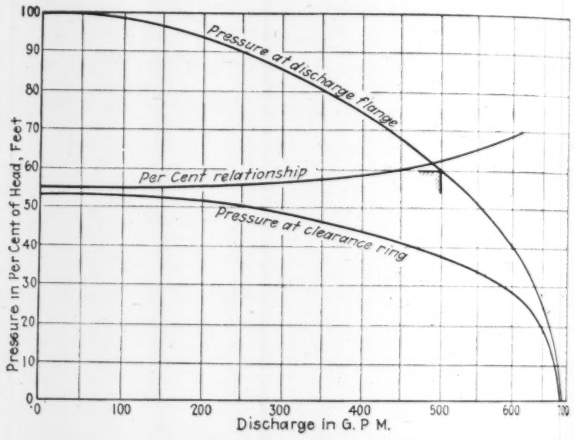


FIG. 1—CURVE OF PRESSURES AT DISCHARGE FLANGE AND CLEARANCE RING

The pump used in these tests was a special 3-in. horizontally-split shell, single-stage, centrifugal pump. This had been especially designed for experimental purposes. The assumption, often made, that the flow through the clearance is caused by the same pressure as that existing at the discharge flange has for some time seemed to the writer extremely problematical.

To throw some light on this question as to the variation in pressure in the pump casing, a hole was drilled through the pump shell so as to record as nearly as possible the pressure existing in the pump at the upstream or high-pressure side of the clearance space. Another gage was attached at the discharge flange of the pump. Readings of these gages were taken simultaneously for various rates of discharge and various speeds. It was found that the pressure at the clearance ring was much less than that measured at the discharge flange for practically all rates of flow and speeds. The only case where they all approach each other is at an extremely high rate of flow which was about the maximum for the pump. The pressure in such cases was very low and rather evenly distributed throughout the pump. This can be seen by reference to Fig. 1, which shows typical curves for the pump under investigation for various rates of flow while running at a constant

speed of 1,200 r.p.m. As will be seen, the pressure at the clearance ring varies in general from 55 to 80 per cent of the pressure existing at the discharge flange of the pump and has a value of from 57 to 67 per cent throughout the working range of the pump. At the point of best efficiency the average value of a large

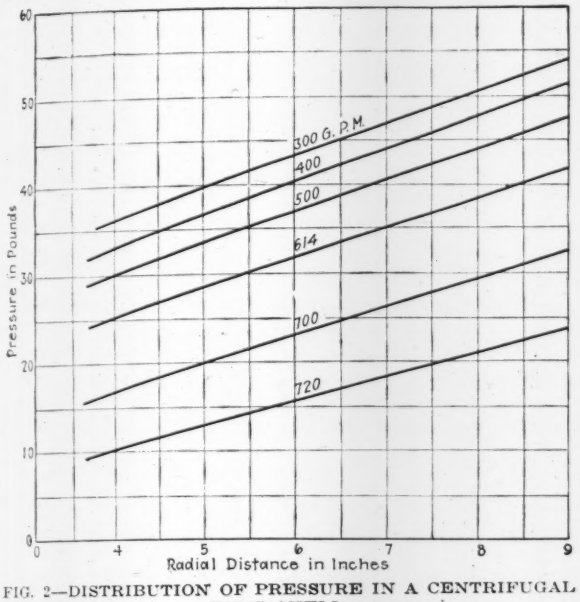


FIG. 2—DISTRIBUTION OF PRESSURE IN A CENTRIFUGAL PUMP SHELL

number of tests was about 60 per cent. This establishes the error of the assumptions now found in various works to the effect that these pressures are the same.

We now see that the centrifugal action of the water revolving with the runner in the pump casing considerably reduces the pressure at the neck of the impeller, for practically all rates of discharge. This appears rational. The only question seems to be the amount by which the pressure is reduced. For the pump on which these tests were made the pressure at the clearance appears to range from 55 to 65 per cent of that at the discharge flange. The lower values occur at the smaller rates of discharge up to the "shut off" point. It should not be reasoned that the data obtained from this pump could be applied to all others. This is evident from Fig. 2. Here we see that the pressures at intermediate points vary about as a straight-line function of the radial distance from the center. Ordinary analysis of the problem would indicate a probable parabolic relation but the facts as we see them are otherwise.

The curves in Fig. 2 were plotted from data obtained by simultaneous readings of several pressure gages attached at various radial distances on the pump shell. They show very clearly the internal distribution of pressure in the shell of a centrifugal pump over the entire range of pump capacity. Such curves could be extremely useful in the study of the problem of axial thrust in such pumps.

Similar studies of the pressure variation were made with various diameters of runner. Lack of space prevents a detailed account of these tests but the general conclusions are of interest. Among other things it was found that the percentage of pressure reduction was about constant for a given diameter runner at all speeds if based on conditions of maximum efficiency for those speeds. It did vary, however, with the diameter of the runner as shown by Fig. 3.

The pump casing had been designed to receive relatively large diameter runners and when operated with the smaller runners the space between the runner and the volute was filled with water rotating to some extent with the impeller. This was found to have a noticeable effect on the pressure reduction. To compare these results it was decided to refer to any diameter of runner as a certain per cent of the maximum for that casing. If we assume that the maximum runner diameter would be that of the circle around which the volute is laid out we may refer to any runner diameter as a certain per cent of the maximum, for purposes of comparison. On such a basis tests were conducted on runners having diameters of 94, 85, and 70 per cent of the maximum. The results are shown by Fig. 3. It should be noticed that the percentage of reduction is greater for the smaller diameter runner and that the percentage decreases as the diameter increases. It appears to be a question of how completely the runner fills the shell.

Having now briefly disposed of the question of pressure we may take up the flow of the water through the clearance. To determine the actual leakage under various pressure differences the procedure was as follows: The suction entrances to the impeller were blanked off by a brass plate secured to the runner by screws and all joints soldered. This prevented any flow of water through the runner. The suction pipe was disconnected at the pump flange and provision made for collecting and weighing the water as it was discharged through the entrance to the pump. Water under pressure from another centrifugal pump was admitted to the discharge line of the experimental pump. This pressure could be varied by means of either the motor speed or a valve placed at a convenient point in the line near the pump. Under this pressure the water would leak through the clearance space between the neck of the impeller and the wearing rings and could be collected and weighed.

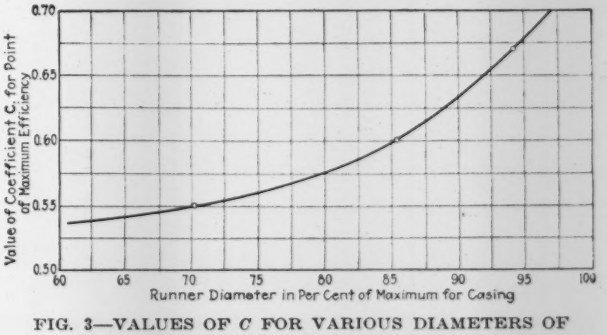


FIG. 3—VALUES OF C FOR VARIOUS DIAMETERS OF RUNNERS IN THE SAME SHELL

Since the suction pipe was entirely disconnected it is evident that the pressure on the low pressure side of the clearance was merely that of the atmosphere. The reading of the pressure gage on the high pressure side would then evidently be the pressure drop due to the actual rate of flow.

The amount of leakage was determined for various speeds of rotation as well as with the pump stationary. Fig. 4 indicates that less water is discharged when the pump is running than when stationary but that when the impeller is once set in rotation the speed has little or no effect on the discharge. A comparison of

the actual with the ideal rate of discharge gives us the coefficient of discharge *C*. This is shown in Fig. 5. A very interesting fact can be noted here regarding the variation of the coefficient of discharge. The value of *C* is seen to depend on the head causing the flow, and apparently the higher the head the higher the value of *C*. Further experiments indicated a similar variation in the value of *C* due to a variation in the amount of clearance. The larger the clearance the higher the coefficient *C*.

The clearance space measured radially varied from 0.003 to 0.012 in. The coefficient *C* varied from about 49 to 85 per cent for an effective head of 100 ft. under the above conditions. This rather wide variation of the value of *C* was unexpected and indicates that the phenomenon is entirely different from flow through ordinary orifices. Different methods must therefore be employed. It seems to partake more of the nature of the flow through capillary tubes.

Having now presented a general view of the problem a practical application will be made of the data obtained in the solution of an actual case. Let us assume that we are to estimate the probable leakage in a 5-in. single centrifugal pump to have a capacity of 1,000 g.p.m. against a total head of 180 ft. The pump is to run at 1,750 r.p.m. Let us further assume that the runner is of the double suction type and that the

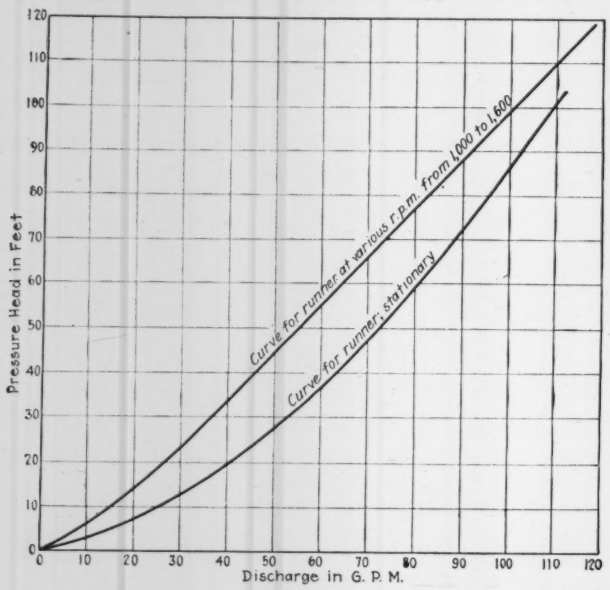


FIG. 4—LEAKAGE CURVES WITH RUNNER STATIONARY AND AT VARIOUS R.P.M.

neck of the impeller is 6 in. in diameter. The wearing rings are, let us say, made $\frac{1}{64}$ in.(.0156 in.) larger in diameter; hence the radial width of the passage though which the leakage takes place is 0.0078 in. These values are about usual in such cases.

The total area of the clearance is very nearly $2 \times \pi \times 6 \times 0.0078$ in. $= 0.293$ sq.in. $= 0.002035$ sq.ft. For a head of 180 ft. the pressure at the clearance space would be not far from 0.60×180 ft. $= 108$ ft. Hence $V = \sqrt{2g \times 108} = 83.3$ ft. per second. Now $Q = CAV$, and taking a value of $C = 0.82$, which would be about what might be expected for the clearance and pressure given we would have $Q = 0.82 \times 0.002035$ sq.ft. $\times 83.3 = 0.139$ cu.ft. per second or 62 g.p.m., which is

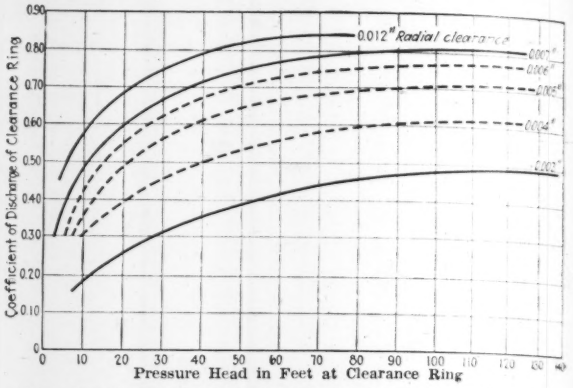


FIG. 5—CURVES GIVING VARIATION OF *C* WITH THE HEAD AND RADIAL CLEARANCE

the approximate leakage that might be expected under the above conditions. Although this problem is by no means extreme we see the leakage is over 6 per cent of the rated capacity of the pump. It is not at all impossible that it may easily run from 15 to 20 per cent or even more in unfavorable cases. As this is somewhat larger than has been generally believed, it is worthy of special notice. In the course of time the clearance is usually increased due to wear and in such cases even larger values may be obtained.

One feature of unusual interest was discovered during these tests. When comparing the results of two experiments on rings about $1\frac{3}{4}$ and $\frac{1}{2}$ in. in width, respectively, other conditions being substantially the same, it was found that the flow through the clearance was apparently not affected by the width of these rings. This was quite unexpected and contrary to the belief of many centrifugal pump engineers and designers.

After further consideration it was quite clear that from the nature of the problem such a result might have been expected, as it is evidently but a special case of the flow through a very short pipe. In such cases it is well known that the length of the pipe within reasonable limits is relatively unimportant.

Torsional Vibrations in Car Axles

In the belief that rail corrugation in street car service is connected with differential slip of the two wheels on an axle, and resulting torsional vibrations of the axle, Dr. J. Geiger, of Augsburg, Germany, recently measured the torsional vibrations of axles in service. His observations are briefly reported in *Zeitschrift des Vereines deutscher Ingenieure* of March 22, p. 282. The instrument used was a recording torsion strain gage of high period; it was mounted on an extension of the truck frame and the motion of the car axle was transmitted to its rotating element by a belt. From the diagrams traced by the instrument, Dr. Geiger finds that on tangent the trace is substantially straight, showing no vibrations in the axle except slight ones produced at rail joints. On curve, however, complex vibrations develop. The highest-period vibration usually had a frequency ranging from 2,800 to 3,600 per minute, as against a computed value of 3,100, based on free rotary oscillation of one wheel, the opposite wheel being taken as fixed. These figures apply to the driving axle. In one diagram vibrations of a frequency over 5,600 per minute were found, however; these might be due to vibrations of the trailer axles.

Settlement of Piers Endangers Waterloo Bridge

Historic Masonry Bridge Over the Thames Closed to Traffic and Repair Begun—Temporary Bridge to Be Built

WATERLOO bridge, one of London's finest masonry bridges, is endangered through settlement of one pier (and possibly others) and was closed to traffic on May 11 because of the resulting settlement of the middle arch. Emergency repair work was begun at once, the first object being to shore up the failing arch by means of pile falsework. Permanent reconstruction of the foundations, or else removal of the bridge and its replacement by a new structure, will then be considered.

For the present it is planned to build a temporary bridge alongside the Waterloo bridge, to carry traffic during the repair and reconstruction work. What to do about a permanent structure depends not only on the condition of the old bridge, but also on traffic requirements. The present structure, 45 ft. wide over the faces of the arches, has a roadway width of only 27 ft., while a very heavy traffic must be carried; it is estimated that 15,000 to 20,000 vehicles cross the bridge per day, among them many heavy motor trucks. The need for a much wider roadway is generally recognized. This has led to suggestions for replacing the failing bridge by a wider stone-arch structure or else by a three-span steel arch bridge. However, the final decision may be deferred pending the findings of a joint committee of the London County Council and the City Corporation which it is proposed to set up to consider the whole question of London's cross-river bridge traffic.

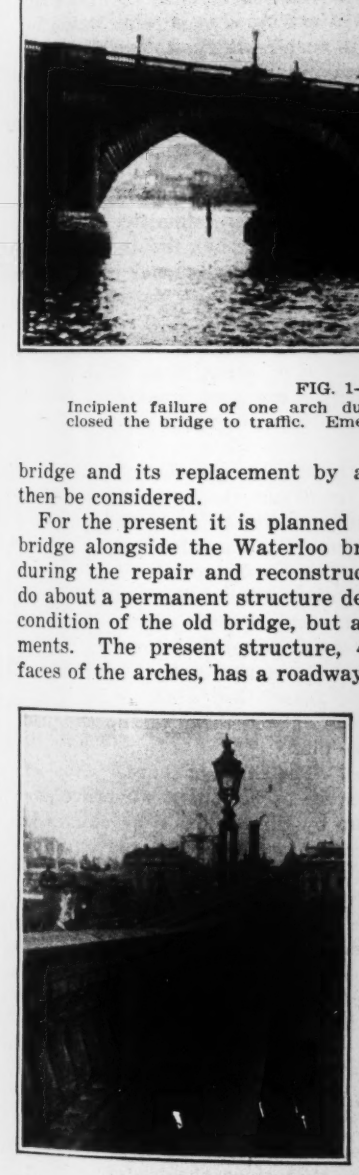


FIG. 2—SETTLEMENT INDICATED BY BALUSTRADE

Waterloo bridge is in the heart of London, and carries a main thoroughfare across the Thames. It has nine granite arches, of clear span about 125 ft. each. The northerly one crosses the Victoria embankment, while the others are over the water.

John Rennie built the structure for a public company. Construction was begun in 1811 and completed six years later. The bridge was opened to traffic on the second anniversary of the battle of Waterloo, June 18, 1817; its total cost was $5,250,000. The structure has always been noted for its beauty. The sculptor Canova is said to have remarked that Waterloo Bridge alone was worth coming from Rome to London to see. Both the esthetic and the historical rank of the bridge would make its removal an event to be deplored.

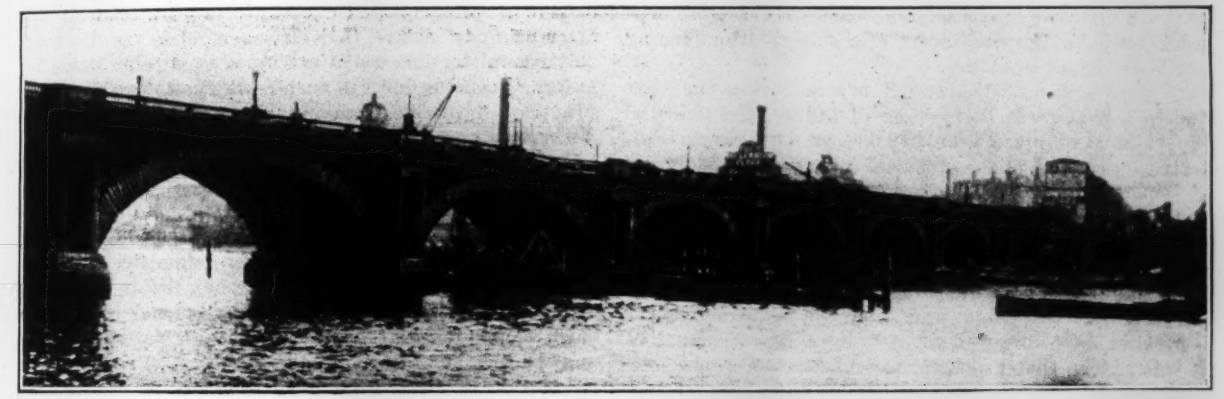


FIG. 1—WATERLOO BRIDGE OVER THE THAMES AT LONDON

Incipient failure of one arch due to pier settlement has closed the bridge to traffic. Emergency repairs are under way. It is possible that the whole bridge may be rebuilt, to provide a wider roadway.

Failure of the central arch is manifested by sinking of the arch ring, spandrel masonry, and balustrade. The upper parts of the spandrel walls are not bonded to the piers, so that besides settling the walls have tilted outwards. The entire facing of the bridge is of granite. The massive balustrade, also of granite, has been so disrupted by settlement at the worst point that the balusters had to be secured by wire rope binding.

While the pier at the north end of this span appears to be primarily responsible, there is some reason for believing that all of the piers are more or less involved. The pier foundations are in a gravel layer overlying the London clay. Beech piles about 20 ft. long were driven into this clay to support 6-in. timber platforms carrying the masonry of the piers. The spaces around the heads of the piles and below the platform were filled with rubble stone well rammed and set in mortar. It is thought that in the course of the century scour has undermined the timber construction of the foundations and the timber has decayed.

Record Reforestation in New York State

The New York State Conservation Commission reports 8,500,000 young trees distributed this spring on 715 orders from farmers and land owners and 32 orders from industrial concerns.

Progress Toward Unity Marks A.A.E. Convention

Firm Action Against Engineering Unionism Taken—Internal Harmony and Effective Program for Strengthening Chapters Sought—Demand Made for Concentrated Committee Work

Engineering News Record Staff Report

TWO HUNDRED delegates and guests gathered at San Francisco last week for the tenth annual convention of the American Association of Engineers. The meeting was marked by an absence of the internal strife that has hampered previous conventions and as a result not only was good progress made in important committee work but there was determined and concerted action for development of the association's activities. Much time and effort were devoted to the professional and welfare work which form the association's primary purpose and earnest endeavor was made to pave the way for closer co-operation among engineers of all branches.

Despite a greatly decreased income during the year due to a change in the system of billing, the financial report showed more than $19,000 gain in surplus, effected by careful and economical management of affairs at headquarters. The heavy membership loss reported last year has stopped, the present membership being about the same as that of a year ago.

Chapter Activities—Chapter activities received perhaps more attention and emphasis than any other one subject. At the same time that the tendency to decentralize was admitted to have been very destructive, it was agreed that proper chapter activities would solve many of the association's problems, and every encouragement and aid is now being given to endeavors to strengthen the chapters and to build up and systematize their activities. In contrast to previous decentralization moves, constructive suggestions toward getting the chapters to work more systematically and effectively were made by the committee on chapter activities. Frankly admitting that no specific rule can be laid down, this committee made a number of vigorously constructive suggestions, among them these:

> Every chapter member shall be known by at least two directors.
>
> A member is entitled to expect some real leadership from his officers.
>
> Better three or four chapters in the big cities where each man is personally known to a hundred members and is greeted by name by the officers, than one big overgrown chapter whose members are largely strangers.
>
> In matters of public works other professions will submit readily to good engineering leadership.
>
> The general chapter program should be prepared on a three or five-year basis and the committee chairmen should be appointed for a term of that length.
>
> An endorsed report recommending public action is a mandate to the chapter to put over those recommendations and the chapter should plan a follow-up campaign that will let every voter in town know what the engineers want to do.

Licensing—Extended discussions on licensing and insurance brought out a general agreement as to the necessity for the first and the desirability of the second. Licensing occupied a central place in the convention work as heretofore. The association will continue to work for the passage of an engineer's registration law in each of the states. The model registration law, revised by the legislative committee of 1922-1923, has been annotated by the legislative committee of 1923-1924. That law as it now stands, together with its annotations, will appear in an early issue of this journal. The need for reciprocal registration and licensing arrangements was emphasized, as was the undesirability of any provision requiring all applicants to take a written examination regardless of credentials.

The national legislative committee has begun the compilation of data for a pamphlet to be entitled "How to put over a registration law and avoid legislative pitfalls." This booklet is to present in convenient form experiences in the various states with licensing laws and methods employed by engineers in securing or attempting to secure their passage. During the year this committee has noted attempts in several states to enforce licensing laws in such a way as to exclude from practice engineers from outside states. Of this the committee says: "This is a wrong attitude and nothing will bring a registration law for engineers into disrepute quicker than this kind of practice."

Professional Conduct—At to the general subject of professional conduct the practice committee reported an endeavor to "study and work out the itemized list of specific principles of good professional conduct in such completeness that infractions of ethical practice may be specified by clause and sentence." Five additions to the previously formulated principles of professional conduct were recommended to bring it up to date. A compilation of 47 practice cases or specific questions arising as to professional conduct was the basis of this work.

Discussion of the insurance question developed a general opinion that, although the association should not enter the insurance business itself, much would be gained by some general arrangement with established insurance companies who would offer special rates to members. The convention authorized the directors to make such an arrangement. Under the plan approved insurance would be entirely optional with members, details would be in the hands of the insurance company and the association would simply offer members the advantages of something taking the place of the group insurance plan.

Professional Welfare—The Chicago chapter situation, which has been the cause of serious disturbance, was permanently cleared up by the expulsion by unanimous vote at the board meeting preceding the convention of the chapter president and two of his associates. This action, following the revocation of the Chicago charter last March, paved the way for a new start at Chicago, which has already been made in the granting of the new charter and the selection of new chapter officers. More than being a local and internal matter, this action puts the association on record as definitely and vigorously opposed to any tendency in the direction of trade unionism in chapter activities and on the contrary declares for the high standards of a society of professional men.

Reference was several times made on the floor of the convention to the fact that since the professional and welfare ideals of the association so effectively supplement the technical activities of other national societies

it would be of mutual benefit to effect some permanent basis of co-operation with them. The retiring president's address stated "a plan could be evolved whereby every engineer who is admitted to the founder societies would first become a member of the American Association of Engineers and show by his work in welfare affairs and general conduct that he is worthy of advancing to the higher technical societies. Such a plan would call for an interlocking directorate, thus giving the technical societies a voice in the general welfare organization." However, the general feeling of the convention was to the effect that the time is not yet ripe for attempting an idealistic move.

Co-operation among the societies was also dealt with in a committee report. The unification committee pointed out that some of the association's activities that have made for greater co-operation as between societies are: (1) A high standard of professional conduct; (2) close observance of a code of ethics consistent with the dignity of the profession; (3) the work of service bureaus in endeavoring to place capable engineers; (4) the general effort to get professional engineers—not politicians—into important government positions where engineering skill and knowledge are needed; (5) an endeavor to secure the passage of just legislation preventing the indiscriminate use of the term "engineering" and requiring that only those qualified should be entitled to practice engineering.

All constitutional amendments proposed were overwhelmingly defeated, thus making this the first convention that did not revise the constitution. The convention authorized a committee to submit designs for a new emblem, approved the establishment of branches of the employment office outside of Chicago, and authorized the establishment of sub-chapters in large centers of population.

Employment Service—Complete justification of the present plan of employment service after six months of active experience with it on a self-sustaining basis was reported by the employment committee. Refinement and improvement are continually being made. For example, it is found advisable to do follow up work after a man has been placed, "to find how he is getting along, whether the job suits him, whether he suits his employer, or whether some other job might be more satisfactory to all concerned." The national employment service is handled by Association Employment, Inc., which is wholly controlled and owned by the A.A.E. and works under specific regulations as to rates to members and non-members.

The financial statement of this department shows the gross income for the year to have been $16,470 with positions found for 458 members and 259 non-members. Under the present plan, members pay 40 per cent of the fees charged non-members for employment service. In addition to the national service, chapters are encouraged to render employment service, limited, however, to local placement, keeping in touch with Chicago headquarters to aid men who desire to change location.

Several committee reports affecting the professional status of the engineer were reported to the convention. In these emphasis was laid upon the need for clarifying fee problems and schedules, upon classification of engineering positions, upon political policies and upon the advantages the engineer may gain through greater knowledge of the legal aspects of his work.

Fees for Practising Engineers—Educational work among those who employ engineers was suggested by the committee on services and fees for practising engineers. It was recommended that a form of contract be prepared to serve as a guide to engineers in writing contracts and to be shown prospective clients. Fees for "plant" work such as hydro, steam, sewage treatment, etc., may fairly be above the standard scale because of the intricate design and time and study required to select proper equipment. On the contrary "spread" work such as sewers, paving, transmission lines, etc., involves relatively simple plans and might well be done for less than recommended fees. In construction work these conditions are likely to be reversed due to the need for more instrument men, inspectors, etc., on "spread" work than on work of the "plant" variety. A printed booklet containing a schedule of fees, typical contract forms, code of ethics, etc., was suggested as an aid in the work this committee is attempting.

Political Policies—Definite recommendations were made by the committee on political policies on three important points as follows: (1) That the United States establish a department of public works with a registered professional engineer as chief executive who shall be a member of the president's cabinet. (2) That the A.A.E. encourage qualified engineers with national reputations to strive for leading positions in the cabinet of the president of the United States, heads of state and federal government bureaus and in other positions of trust and responsibility. (3) That the use of civilian engineers for civilian work be encouraged. In this connection the report quoted in full an *Engineering News-Record* editorial that appeared Jan. 31, 1924, p. 180.

Engineering Law—The duty of studying and publishing abstracts of decisions of the higher courts of the land that relate to engineering work was taken up early this year by the committee on engineering law. This committee recommended that the association should eventually undertake the publication of a book in which a classified digest of such decisions can be made conveniently available. Endeavor is being made to make known promptly decisions that may be useful to the profession. The committee's report stated: "The present-day engineer in responsible charge of work must know the laws involved in his obligations as well as the engineering problems he confronts. The engineer's law is constructive, not litigious. The lawyer-engineer prevents legislation as the sanitary engineer prevents disease; he can no more dispense with the lawyer than the latter can dispense with the physician. But when litigation comes, as at times it must, he brings his lawyer a case, not a corpse."

Classification of Engineering Positions—The committee on specifications for engineering positions has entered into an agreement with the National Research Council whereby the report on specifications for highway engineering positions has been printed by that body (Bulletin 45, dated May, 1924). This report, the committee chairman stated, presents "a clear specification of what highway engineers must know and be able to do in order satisfactorily to meet the requirements of the various engineering positions in highway work." Attention was called to the fact that if the work of this committee is to be carried on, steps must be taken soon to provide for further financing.

Reclamation Recommendations—Special consideration in a committee report was given the subject of reclamation. A committee on land reclamation and settlement, appointed late last year, proposed a national legislative act to contain the essential points needed to remedy the present reclamation situation. The bill would "create a bureau of land reclamation and settlement and provide for utilization of waste lands where available for creating opportunity for small self-supporting farm homes for ex-service men and other citizens." The study by this committee leading up to the formulation of this bill led to several conclusions, namely, that a large number of small farm homes make for stability of government and business, that large areas of both arid and wet lands are still available if properly reclaimed, that there is now a temporary excess of land suitable for farm homes and that when this excess is exhausted there should be operative a national reclamation policy (an improvement on the present reclamation law) that would apply to all sections of the country and would provide for logged-off lands and wet lands as well as arid lands.

Further information on the proposal of this new committee will appear in a later issue.

Included in other committee reports were recommendations that chapters be assured systematic dissemination of information concerning congressional activities, that broader study be made of public works with a view to the possible discovery of greater economy in government expenditures and that chapters devote special attention to the problems of the railroad engineer.

Taxation and Public Works—A very comprehensive discussion of the subject of taxation and revenue was submitted by the committee on public service and the tax rate in the endeavor to arouse interest and bring out further ideas. Attention was given particularly to the investigation of (1) National revenue and taxation, (2) economy and efficiency of administration and (3) the need of a systematic plan of public improvements. In general the plan recommended by the committee is "intended to reconcile conflicting interests of the state and to bring about a full and adequate taxation of income, property and business, and to secure as much income as the states and local governments can hope to derive from these sources."

Railroad Problems—The railroad advisory committee recommended that local chapters devote at least one meeting each year to railroad matters, securing as speaker of the evening a representative railroad executive. Problems confronting railroad engineers to which special attention was called are (1) the rapidly increasing use of the automobile in competition with railroad service which should be studied in the light of its future effect on rail traffic and (2) grade crossings. In this latter subject a phase warranting careful consideration of the railroad engineer is the financing and distribution of cost of grade separation. The committee placed so much importance on this matter that a special committee on equitable division of grade-crossing costs was urged. Attached to this committee's report were letters from eight noted railroad executives in which each gives a list of books recommended for reading and study by young engineers in railroad work.

Ideals and Objects—Views of far-reaching influence upon the possible future of the association were outlined by the report of the committee on amplification of ideals and objects (Prof. A. N. Johnson, chairman). The report was based in part on opinions expressed by a large number of members in answer to a questionnaire sent out to discover the most urgent needs of the association. Most of the suggestions made in these replies referred to activities in which the association already is engaged, but it was evident that many members desire greater activity, a broader range of work, and more tangible results.

The report, after considering the relation of the association to technical societies, comes to the conclusion (1) That the association cannot logically be conducted as a competitor for membership with technical societies; (2) that a general professional organization outside of the technical societies and embracing all members of the profession is necessary if the profession is to be adequately represented; (3) that the dues of such a general organization should not exceed $5 per year. It was also concluded that in order to permit the association to occupy the position of such general organization, it must continue to endeavor for sympathetic co-operation with the technical engineering societies and should cultivate those activities which are the proper work of such a general organization and which would lead logically to the proper helpful relationship with the societies. Development of the employment service was urged, improvement of the association's journal, encouragement of chapter activities, and the stimulation of such activities by a field secretary service.

Bureau of Standards Divisions Regrouped

BY REGROUPING of divisions in the Bureau of Standards, just completed, all work in mechanics has been brought under one head, and now forms Division VI, Mechanics and Sound, under Dr. L. J. Briggs, chief of the divisions. The Engineering Mechanics laboratory, engaged in investigating the strength of engineering materials, chiefly metals in structures and other fabricated forms, has been transferred to this division and now forms Section 5 under the direction of H. L. Whittemore. One factor in the change is that while many of the tests made in Section 5 are of a routine character, the investigations often involve mathematics and physics to a degree making close contact with other work in these fields advantageous.

An interesting item of work recently required in this division was the moving of the two largest testing machines to the new industrial building. These are the 2,300,000-lb. Emery testing machines, formerly in the West building, and the 10,000,000-lb. Olsen compression testing machine, formerly at Pittsburgh. These are said to be the largest testing machines of their kind in the world. A 600,000-lb. universal testing machine was also moved from Pittsburgh to the industrial building. Officials of the Bureau of Standards state that the laboratory is now in a position to undertake the problems before it with renewed vigor, and to assist engineers in working out the problems of metallic columns and of stresses in complicated structures.

An advisory committee on structures and fabricated metals has been formed by the Bureau to advise in the planning of work of the Engineering Mechanics section. This committee is formed of representatives of engineering societies, government departments, and independent interests. At the first meeting of this committee, held recently, the current work of the section was reviewed.

What Is a Day's Work Building Concrete Roads?

Three Years' Records in Iowa Show That a Concrete Road Contractor Loses Over One-Third the Time He Is on the Job

By H. K. Davis

Chief Inspector, Iowa State Highway Commission, Ames, Iowa

COUNTS of construction delays on concrete paving in 1923 on Iowa state roads afford a complete verification of similar counts made in 1921 and 1922. If we may judge safely from these records of three years the conclusion that a contractor may expect to lose in the neighborhood of one-third of the time he is occupied with a paving job seems hard to escape. Conditions may change in the future, but, as the paving industry is now organized, few contractors in Iowa have been able to beat the figure stated while many have not done so well.

Unless a contractor is willing to work Sundays and holidays these alone automatically lose him 15 per cent of the time he spends in the field. Weather in the average year in the Middle West accounts for a like loss, and breakdowns, shortages of material, moving and re-erecting plant, and such delays, each add a small toll. In the end the contractor winds up with a total of time lost that few would anticipate who have not gone into the cold figures. On all the work done on the Iowa highways in three years, there has been a loss of 36.5 per cent of the time on the job. An article in *Engineering News-Record* May 4, 1922, p. 720, describes in considerable detail the method that was pursued to obtain the information contained in the tabulations mentioned. It may here be emphasized that it came direct from the job on the daily reports of the inspectors.

TABLE I—GENERAL DATA ON CONCRETE PAVING OPERATIONS IN IOWA FOR THREE YEARS

	1921	1922	1923	Average
Total feet of pavement laid	798,245	532,401	519,399	616,682
Total miles of pavement laid	151.18	100.83	98.37	116.79
Average feet laid per construction outfit in season	27,525	28,021	34,627	30,058
Average miles laid per construction outfit in season	5.22	5.30	6.558	5.693
Total calendar days in construction season	223	217	215	218.3
Average calendar days elapsed on the work per outfit	114.3	100.8	117.5	110.87
Average days per outfit on which pavement was laid	74.1	61.2	76.4	70.57
Percentage of calendar days on which pavement was laid	64.80	60.73	65.04	63.52
Average feet laid per calendar day per outfit	241.0	278.0	294.8	271.3
Average feet laid per day worked by outfit	371.5	457.0	453.2	427.2
Construction outfits engaged	29	19	15	21

Table I summarizes certain data regarding Iowa pavements during the three years mentioned. As will be noticed the mileage is not large in any year, yet it has the advantage of being about the same each year. Also it has been fairly well distributed over the state, no very large mileage having been bunched in any one location nor executed by any one contractor.

The length of the construction season has been decided on by a count of the calendar days from the day the first outfit pours concrete in the spring until the last one closes down in the fall. With many contracts let in the fall and winter it is a safe bet that somebody will be ready to pour concrete as soon as the weather will permit in the spring, and with some work always carried over to the succeeding year it is equally certain that some one will run as late as it is safe to do so in the fall. This method has given a construction season in Iowa about 220 days long. It is conceded, however, that the closing down date might in almost any year be expected to come two weeks earlier than has been the case in any of the three years under discussion.

TABLE II—WHOLE DAYS DELAYS IN THREE YEARS OF IOWA CONCRETE PAVING

	Per Cent of Total Time Spent on Job			Average for	Deviation from the Average		
Cause of Delay	1921	1922	1923	3 yrs.	1921	1922	1923
Sundays and holidays	14.20	13.67	12.14	13.34	+0.86	+0.33	—1.20
Snow, rain, mud and frost	14.70	9.72	15.27	13.23	+1.47	—3.51	+2.04
Breakdowns of equipment	1.09	0.47	0.74	0.77	+0.32	—0.30	—0.03
Shortages of materials	1.14	9.83	1.99	4.32	—3.18	+5.51	—2.33
Moving equipment	2.56	2.56	3.18	2.77	—0.21	—0.21	+0.41
All other causes	1.51	3.02	1.64	2.05	—0.54	+0.97	—0.41
Total, all causes	35.20	39.27	34.96	36.48	—1.28	+2.79	—1.52

It will be noted that the average mileage laid per season by each outfit has increased somewhat in 1923 over the preceding years. Two reasons are offered: First, there has been in general an increase in the capacity of the equipment used, more large mixers being put on the work than formerly, and second, the work has been let in units more nearly of a size to occupy an outfit for the entire season. This last has a very important bearing on the capacity of an outfit for an entire construction season, though of course the daily runs show to no better advantage.

In 1923 we find ourselves back to the old criterion of 1921 as regards total time worked, namely, that 2½ months of steady pouring time would have laid all the concrete placed in the state during the year.

Table II classifies the principal causes of delay by means of percentages of the total days spent on the job. A considerable number of Sundays and holidays were worked, which reduced the percentage lost from this cause to an average of 13.34 for three years instead of 15 per cent which otherwise would have been lost. The weather was unusually favorable in 1922 when only 9.72 per cent of the time was lost from this cause. In 1921 and 1923 the season was much more nearly what is to be expected in Iowa. These two years would average almost exactly 15 per cent time lost from weather. The year 1922 was also abnormal as to the supply of materials available to the job. Railway traffic conditions were frequently the cause of contractors being unable to supply their needs. Consequently the shortage of materials made up an abnormally large percentage of all the time lost in this year.

TABLE III—FRACTIONAL-DAY DELAYS IN THREE YEARS OF IOWA CONCRETE PAVING

	Per Cent of Days Worked on Which Delays Occurred			Average for Three	Deviation from the Average		
Cause of Delay	1921	1922	1923	Years	1921	1922	1923
Snow, rain, mud and frost	12.41	10.31	14.92	12.55	—0.14	—2.24	+2.37
Breakdowns of equipment	5.21	5.24	6.89	5.78	—0.57	—0.54	+1.11
Shortages of materials	2.51	3.35	4.10	3.32	—0.81	+0.03	+0.78
Moving equipment	1.58	3.78	3.67	3.01	—1.43	+0.77	+0.66
All other causes	4.55	6.70	12.39	7.88	—3.33	—1.18	+4.51
Total, all causes	26.26	29.38	41.97	32.54	—6.28	—3.16	+9.43

Averages have been struck for the three years on the various causes for lost time. The fact that the deviation from the average figure for the three years is, in so many cases, merely a fraction of 1 per cent seems to indicate that the averages are quite indicative of a general condition.

Table III shows the days on which some considerable delay occurred even though pavement was laid on that day. These are of course of materially less importance than the whole days lost, but still are worth considering by the contractor.

It is felt here in Iowa that the case has been proven. Three years' data are of course no great accumulation so far as time goes, but the close agreement during these years indicates that nothing but an abnormal state of affairs will throw the results out of line. It is thought that by a judicious use of the tabulations for the three years a contractor can arrange a fairly close schedule for his organization or an engineer can calculate the probable progress of his contractors.

Mississippi Car-Transfer Steamer for Gulf Coast Lines

Three-Track Boat for Passenger and Freight Car Service—Two Geared Engines Operate Paddle Wheels Independently

FERRY TRANSFER across the Mississippi River at Baton Rouge, La., has to be provided for through trains on the main line of the Gulf Coast Lines, between New Orleans and Brownsville, Texas, and in order to handle the increasing traffic efficiently, a new side-wheel car-transfer or car-ferry steamer has been put in service recently. This boat, shown in Fig. 1, has a length of 346 ft. over all, with a beam or width of hull of 56 ft.; width over deck, 91½ ft.; depth of hull, 11 ft.; loaded draft, 6 ft. Three tracks provide capacity for eleven passenger cars or twenty-three freight cars. This steamer has a dead weight of about 1,500 tons, and a maximum speed of about 12 m.p.h. with full load and in still water.

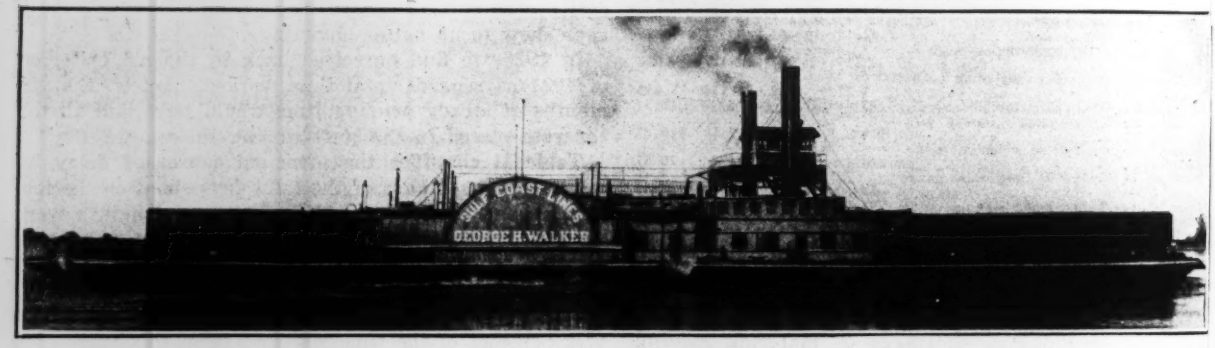


FIG. 1—CAR-TRANSFER STEAMER "GEORGE H. WALKER," GULF COAST LINES RY.

The flat-bottom hull, with frames 27 in. apart, is stiffened by three longitudinal bulkheads, one under the center of each track, the design being such as to provide for a track loading equivalent to Cooper's E-60 class. The center line bulkhead is continuous, while the others are composed of separate panels framed between transverse bulkheads. In this way the hull is divided into several watertight compartments, two of which are also made oil tight to serve as tanks for fuel oil. At the bow, where the three tracks converge into two, special longitudinal bulkheads are provided under the turnouts. To connect the boat tracks with the incline track on the landing dock, there is placed across the bow a fixed apron or shelf projecting 5 ft. from the hull; this is supported by brackets on the hull and has the bottom formed by a horizontal lattice truss. Along each side of the boat is a deck house for the engines, boilers and quarters. Steel trusses 40 ft. long, built into the inboard sides of these structures, are connected by overhead transverse trusses which support the wheel house and navigating bridge, as shown in Fig. 2.

Cantilever brackets or outriggers supporting the overhang of the deck are attached to alternate hull frames at the machinery spaces and to every fourth frame elsewhere. At the paddle wheels, these brackets are riveted against transverse bulkheads and are composed of solid web plates with double-angle flanges or chords. The two heavy brackets at each wheel carry a longitudinal girder upon which is mounted the outboard bearing of the wheel shaft.

Where the brackets support the concentrated loads of the engines and boilers, they are supplemented by ties and by four lateral trusses or hog trusses on each side of the vessel (Fig. 2). Each hog truss consists of a horizontal and a vertical rod, the former attached to the top chord of the longitudinal truss and the other to the end of the cantilever bracket. The adjacent ends of the rods are attached to a cap on a diagonal or inclined strut consisting of a 10-in. steel pipe seated directly over the side of the hull. Tension on the rods is adjusted by turnbuckles. In addition, there are two diagonal ties consisting of 7-in. pipe, having pin connections at the top to the truss columns carrying the bridge deck and at the bottom to a channel along the ends of the cantilever brackets.

A clear deck width of 38 ft. 8 in. between the deck houses provides for three tracks spaced 12 ft. 2 in. c. to c. These tracks have 85-lb. rails carried by cast-steel chairs riveted to the ⅝-in. deck plating, the chairs being of varying thickness in order to take out the camber of the deck. Bolted clips secure the rails to the chairs. At the forward end of the deck, the two outer tracks converge to a spacing of 12 ft. 2 in. on the apron, and the central track has switch connections to both these tracks. Since the boat is single ended, the tracks have heavy steel bumpers at the stern, well braced and tied to the track rails.

Geared drive for the paddle wheels is an unusual feature of the machinery. Furthermore, since the car space made it impracticable to apply a single transverse shaft carrying both wheels, each wheel forms an independent unit with its own engine and boilers. Maneuvering of the boat is facilitated by independent operation of the two wheels. Powerful steering capacity is provided also by two large balanced rudders

placed side by side and operated by steam steering gear.

Each engine, with two inclined opposed cylinders 18 x 25 in., is rated at 600 hp. with 200 lb. pressure and running at 90 r.p.m. On the crank shaft is keyed a 21-in. pinion with 21 teeth, gearing with a 125-in. spur wheel having 125 teeth and keyed to the paddle wheel shaft, so that at full speed the paddle makes 15.12

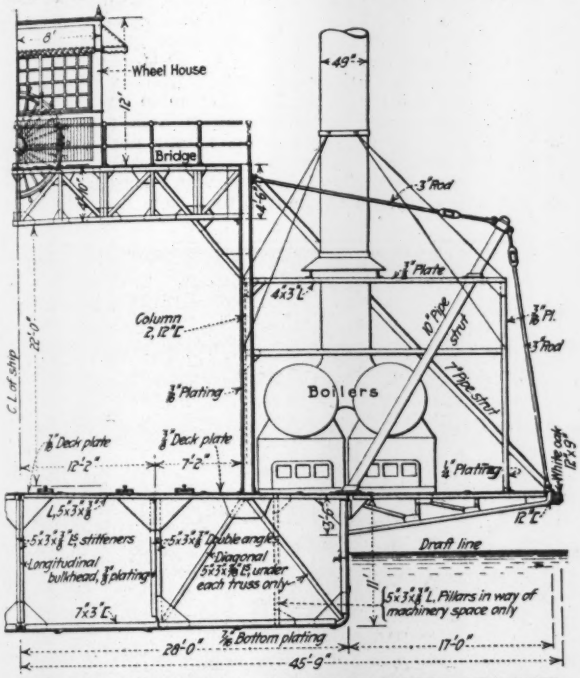


FIG. 2—HALF SECTION OF CAR-TRANSFER STEAMER

r.p.m. with the engine making 90 r.p.m. The paddle wheels are 30½ ft. in diameter over the fixed wooden buckets or floats, which are nineteen in number and 3 x 14 ft. in size. Feathering floats are rarely used on the river steamers, owing to the great amount of drift and the liability of its clogging the mechanism. For each engine there are two water-tube boilers, burning oil fuel and carrying 200 lb. pressure.

This car ferry steamer was designed and built by the Dravo Contracting Co., Pittsburgh, Pa. It is named the "George H. Walker," after the present chairman of the board of the Gulf Coast Lines.

Very High Multiple Arch Dam in Italy

A concrete multiple arch dam 286 ft. (87 m.) high is under construction in Italy, according to a tabulation of dam work in that country published in *Annali delle Utilizzazioni delle Acque*. It exceeds the Tirso dam in southern Italy, built last year, by fully one-third, the Tirso dam being 213 ft. (65 m.) high. The 286-ft. dam is for the Suviana reservoir, on the Limentra di Treppio brook in the province of Bologna, and is to give a storage capacity of 35,000 acre-ft., of which 29,000 acre-ft. will be utilizable storage. It is being built for the State Railways of Italy. The same department is also building another concrete multiple arch dam of large proportions, though smaller than the Tirso and the Suviana. This is for the Pavana reservoir across the Limentra di Sambuca brook, also in Bologna, and will be 187 ft. (57 m.) high, to store 810 acre-ft.

Stress Distribution Tests of Concrete Continuous Girder Bridge

MEASUREMENTS of stresses and deflections of a three-span reinforced-concrete girder bridge recently carried out by M. Ros, of Baden, Switzerland, gave some interesting results. Tests were made under dynamic as well as static loading. They indicate a very complete distribution of load over the width of the bridge, close agreement between measured and calculated stress distribution, a very high value of the rigidity of the concrete, and a relatively low impact factor.

The bridge, crossing the Aa River at Rempen, was built during August, 1923, and was tested two months after its completion. It consists of a central span of 85 ft. (26.1 m.) flanked on either side by a 65½-ft. (20 m.) span. The width of structure is 14 ft. 3 in., in which width there are five ribs or girders, each 51 in. deep and 16 in. thick, integral with the 6½-in. reinforced floor slab. Transverse diaphragms connect the girders at intervals of about 15 ft. The piers at the junction of center and side spans are unusually slender, being only 24 in. thick and of the same width as the bridge deck.

At one end the bridge structure rests on an abutment, while the other end is carried on a rocker support, providing for expansion. The structure was designed and built by Locher & Co., of Zürich. The concrete was of about 1:6½ mixture, using river aggregates, and 7 per cent water. Deflection tests were measured at the center of main and side spans for all five girders, using dial gages. Deflections under moving load were obtained by a recording (curve tracing) instrument. The angular movement of the superstructure directly over the expansion-end support and over one of the intermediate supports was measured by clinometer. Stresses in concrete and steel were measured simultaneously at seven points of the periphery of one girder by extensometers which read on a 40-in. gage length.

From the latter measurements it appeared that the stress distribution from top to bottom of the girder section follows almost precisely a straight line. Stress and deflection measurements taken together indicated a value of about 4,800,000 lb. per sq.in. for the elastic modulus of the concrete. This figure was based on comparison with calculations taking account of full tension in the concrete. Applying this value of the modulus to the stress measurements, the check between observed and calculated stresses was very close.

Transversely, the deflections of the five girders were so nearly alike as to justify the conclusion that under symmetrical load the entire road structure acts as a unit.

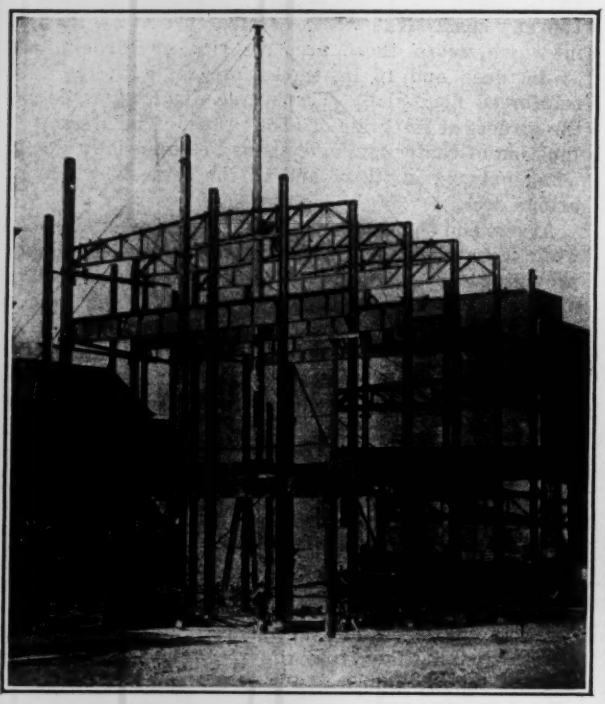
Under the moving load of a 12-ton motor truck, running at about 20 miles per hour, the deflection diagram showed a dynamic increment of about 20 per cent. At 8 miles per hour the dynamic increment was less than half as large.

Mr. Ros in reporting these tests (*Schweizerische Bauzeitung*, May 24, p. 241) says that it is intended to repeat the measurements after two years, at the same time making other observations as to the condition of the bridge, levels, hardening, and the development of cracks.

Unbraced Steel Building Frame Collapses in Spokane

Steelwork of Four-Story Masonic Temple Annex Topples Over—Frame Lacked Guys and Bracing Struts

COLLAPSE of the nearly completed steel framework of the four-story Masonic Temple Annex in Spokane, Wash., on May 9, has been found on investigation to be chargeable to absence of proper bracing of the steel frame. The building was being constructed by Fred Phair, general contractor, but the steel contract was sublet to the Minneapolis Steel & Machinery Co., which in turn sublet the erection of the steel to C. L. Graves. The building was to cost $300,000. The entire frame collapsed, except four columns along the wall of the old building, which adjoins the new structure to the west.



FRAME OF MASONIC BUILDING ANNEX BEFORE AND AFTER COLLAPSE

At left: view taken on the day before the accident, looking southwest.

At right: view taken shortly after the collapse, looking northeast from corner of old building.

In its structural design the building was unusual in having a series of transverse steel bents consisting of columns and transverse plate girders and trusses, connected longitudinally by reinforced-concrete stringers and floor slabs. Erection of the steelwork was about completed, and the erection derrick was being taken down at the time of the accident. No concrete above ground level had been placed.

An investigation of the accident was made by C. A. Burnette and B. J. Garnett, as official investigating commission. Their report describes the condition and indicates the causes of the collapse as follows:

Condition of Building—With the exception of two columns of minor importance, all the steel framework was in place and riveted. All the columns supporting the south end of the bents were embedded in concrete about 10 ft. The columns supporting the north ends of the first three bents from the west end were not embedded but were set inside timber cribs on concrete footings which were about 8 ft. below the surface of the ground. Both columns of Bent 4 were embedded in concrete, as were all columns east of Bent 4 [the numbering begins at the old building and extends east—EDITOR]. All concrete footings were founded on solid rock.

Bracing—During the erection of the steel, hemp rope guys had been used to support individual columns until the steelwork was up to the top of the lower girders. At this time the derrick was hoisted up to the top of the lower girders and supported by 12 x 14-in. timbers lying on the lower girder of Bents 3 and 4. One cable guy was placed from a point on the north column of Bent 4 at the level of the lower girder to anchorage in the northeast corner of the old building. This guy was removed several days before the accident One cable guy was placed from a point on the north column of Bent 1 to a pole near the northeast corner of the new structure. This guy was loosened several days before the accident and was lying on the ground. One guy was placed from the small box girder at the south end of Bent 4 to an anchorage in the base of the southeast corner of the old building; this guy was never tightened but was in place when the failure occurred. One guy was placed from the center of the top of the roof truss in Bent 3 to the top girder in Bent 2, but added little to the stability of the structure. This guy was in place at the time of the accident.

There was a continuous line of 4 x 6-in. struts placed between bents from the old building to Bent 4 at the level of the lower girder at both ends of the bents. The strut between Bents 3 and 4 on the north had been taken out the day before the accident. There was also one strut between the old building and Bent 1, and one between Bents 1 and 2 at the level of the upper girder. There was no evidence of other struts or guys on the structure.

Structural Conditions—At the time of the failure, the north columns of Bents 1, 2 and 3 were in an entirely unsupported condition. All guys for these columns were either loose or removed. The removal of the strut between the north columns of Bents 3 and 4 the day before the accident and the removal of the 12 x 14-in. supports for

the derrick just before the accident left the north columns of Bents 1, 2 and 3 entirely unsupported toward the east, and they were in a state of unstable equilibrium.

Probable Causes of Failure—The unstable state of the north columns of Bents 1, 2 and 3 was such that a relatively small force only was necessary to swing their tops east. This force could have been caused by a light gust of wind, or the easterly component of the strain of the cables supporting the mast of the derrick which was being lowered. Although the south columns were embedded in concrete and were self-supporting, the torsional stress caused by the failure of the north columns was sufficient to cause their failure. This is proven by the condition and location of these columns after the failure.

In the erection of such a structure as this, where the structure in itself is not self-supporting during construction, extreme care should be exercised to see that all parts and the whole are temporarily stayed by a system of guys and struts to resist safely any stress caused by wind or erection operations. This failure could have been prevented by proper temporary bracing and guying of the framework until the connecting concrete parts were in place and aged sufficiently to carry the load.

What Are Penn State Engineering Graduates Doing?

Over 700 Replied to Questionnaire—Two-Thirds Have Remained in Their Special Fields—Occupations Classified

TO OBTAIN an index of the effectiveness of the engineering courses at Pennsylvania State College, the Dean of the School of Engineering, R. L. Sackett, sent a questionnaire to the 2,400 graduates of that school asking a number of questions concerning their experience since leaving college, their present positions, the value of the various courses which they took at college, their salary at different periods since leaving college, etc. Over 700, or about 30 per cent, replied. Of these, only 5 per cent have left engineering fields for others and of the others two-thirds have remained in the special branch of engineering which they followed in their college course. In determining what men are still in engineering, the definition of engineering adopted by the Engineering Council was used: "Engineering is the science of controlling the forces and utilizing the materials of nature for the benefit of man, and is the art of directing and organizing human activities in connection therewith." Where there was a question of doubt, such as in the case of some sales engineers, they were classified as being in non-engineering fields unless there was ample evidence that engineering knowledge was required in their present work. The following table gives the classification of the 737 graduates who answered the questionnaire:

POSITIONS NOW OCCUPIED

1	*Draftsman*, apprentice, inspector, cadet, engineering assistant	129
2	*Foreman*, chief of party	42
3	*District*, division, resident, city, operating engineer	184
4	Chief engineer	22
5	Consulting engineer	15
6	Research engineering	14
7	Sales engineering	63
8	Miscellaneous engineering	44
9	Independent engineering business	21
10	Assistant manager, assistant master mechanic, assistant superintendent	45
11	General manager, manager, superintendent	82
12	President or vice-president	13
13	Teachers of engineering subjects	24
14	Non-engineering	39
	Total	737

Only those in Groups 1, 2, and 3 are in the actual active practice of engineering, design, construction, testing, and operation with a minimum of executive responsibility. This number is about 48 per cent of the total. The more distinctly managerial positions comprise about 27 per cent of the total. It should be noted that the average number of years out of college of those answering is only seven, because of the larger classes which have been graduated in the last ten years.

A study of the drift within the engineering field shows that 66 per cent of the civil engineers, 60 per cent of the electrical, and 70 per cent of the mechanical engineers have remained in the field which they followed in college.

A study of the principal functions of the present work of these graduates on a percentage basis gives: Administrative, 29; construction or operation, 26; design, 15; sales, 13; and the remainder, 17 per cent, divided about equally between research, testing, consulting engineering, teaching and non-engineering.

Salaries were not reported for consecutive years, but only at intervals of about three years, and in the case of those who graduated before 1914 only every five years. As an illustration of how the salary of beginners has increased, those who graduated between 1898 and 1902 reported average salaries for the first year of $600; those who graduated in the period 1913-15, averaged $1,015, and those who graduated in 1922 or 1923 averaged $1,600. The following table gives the salaries of those reporting:

	Number Reporting	Average Salary 1922–1923
First year out of college	108	$1,600
Second year	168	2,130
Fifth year	88	3,110
Eighth year	143	4,710
Thirteenth year	128	4,870
Seventeenth year	46	6,840
Twenty-second year	15	7,000
Twenty-fifth year	27	9,200

The number who graduated before 1898 was small and the analysis was not carried beyond that point, the graduates before that time being included in the 25-year period. Consequently the figure is somewhat higher than it otherwise would have been.

Water-Works of Tsingtao, China

An interesting description of the water-works of Tsingtao, China, written by I. H. Pei, a former student of Prof. George C. Whipple at the Harvard Engineering School, appears in the November *Journal* of the Association of Chinese and American Engineers, published in Peking. The original supply system, built by the Germans in 1901, consisted of 14 wells furnishing about 0.16 m.g.d. but this was enlarged as the city developed, especially after the Japanese took possession in 1914. At present the consumption is about 2.9 m.g.d. or 22 gal. per capita, for a population of 130,600, the population having more than doubled in ten years. The increased use of water is due largely to the introduction of the modern watercloset. The water rates are on a sliding scale: 57c. per 1,000 gal. for 26,400 gal. or less; 45c. between 26,400 and 264,000 gal. and 23c. for all above the last-named figure. Special rates are given to the families of the Japanese civil service, the amount paid depending on the salary received. The Japanese consume more water per capita than the Chinese and also waste more. Enlargements of the distribution system, more wells, a larger reservoir, and a laboratory are recommended to provide for the rapidly increasing population and to safeguard the quality of the supply. The hardness of the water is about 50 parts per million.

Engineering Literature

A MONTHLY REVIEW OF BOOKS AND A LISTING OF NEW PUBLICATIONS

Stress and Strain

REVIEWED BY GEORGE PAASWELL
Structural Engineer, New York City

DRANG UND ZWANG: Eine Höhere Festigkeitslehre für Ingenieure—Von Dr.-Ing. August Föppl, Professor an der Technischen Hochschule in München, Geh. Hofrat; und Dr. Ludwig Föppl, Professor an der Technischen Hochschule in München. Vol. I, Second Edition. Paper; 7x10 in.; pp. 359; 70 line cuts. Paper, 14 marks (gold), cloth, 15 marks (gold), in Germany.

The authors of this text on Stress and Strain, encouraged by the reception of the first edition, have prepared an enlarged second edition. The older author needs no introduction to the engineering public, having published practically an engineering encyclopedia on structural analysis. The present text is essentially a research book on the so-called higher analysis, but is so admirably presented that it may well form the basis of all conscientious engineering design requiring the analysis of the complex type of structures. The mathematical theory of elasticity, as it is usually presented, forms so indigestible a mass that but few engineers are bold enough to avail themselves of its important theorems. The clear presentation of the problems and their solution, as given in this text, makes correct stress and strain analysis available to practically all designers of fair mathematical training.

The mathematical analysis of elasticity concerns itself primarily with the determination of the deformed configuration of a loaded body. Once the state of strain is known, the stresses may be found by comparatively simple and direct formulas. The state of strain is given by the relative displacements of the points, and these displacements are obtained usually by solving one or more differential equations. The methods of obtaining the differential equations and the processes pursued in their solution are presented in so readable a form that there is little difficulty in accepting the results and making practical application to specific problems.

The reviewer is amazed at the simple and almost universal applicability of the method of virtual velocities. Heretofore it has seemed, except for a few simple and unimportant cases, to be merely a device for using the calculus of variations. One cannot sufficiently emphasize the patience of the authors in presenting step by step this part of the analysis so that the average engineering reader can follow with little trouble the treatment of specific problems. It may be well to note here that while the mathematical erudition of the authors is apparent, there is no attempt to make the text an exhibition of spectacular mathematical gymnastics. Practical application is the keynote of all the analysis.

One-third of the text covers a thorough treatment of the plate. One leaves this part of the book with a feeling that the plate can now be as conscientiously designed as the beam or column. A differential equation is formed, the solution of which determines the elastic distortion of the middle surface. The authors assume an expression satisfying the edge conditions, and also forming a solution of the differential equation. The proper values of the coefficients cover both free and fixed supports. The rectangular plate is analyzed for all types of loading and supports. Most of this work is new and all the results are of simple application to slab design. Circular and elliptical plates, which can be and have been directly analyzed without any approximate assumptions (save those parallel to the usual flexure assumptions), are dealt with in very complete form. Unfortunately, it is the rectangular and not the circular plate which is the important structural unit.

In a solid of comparatively infinite extent, under a symmetrically distributed load, a typical section should exhibit all the necessary stress and strain relations. This is termed plane stress and strain. Its analysis is usually too complicated to lead to practical results. The authors are to be congratulated, therefore, on their keen digest and presentation of this method and their solution for odd-shaped members, such as rollers, wedges, bearing surfaces and the like. A stress function (the Airy function) is found for each case, the differential coefficients of which determine the stress systems in the solid. This analysis is not, of course, new, but the authors have made it of practical application instead of merely exhibiting the method as a mathematical exercise.

There is an admirable treatment of the Poisson ratio and the hazards of its introduction into formulas. The subject of plasticity is also briefly covered.

One leaves the text with a firm feeling that the mathematical theory of elasticity has at last been given a square deal and that practical contact has been made with its important theorems.

World Survey of Engineering Literature

THE ENGINEERING INDEX, 1923—New York: American Society of Mechanical Engineers. Cloth; 7x9 in.; pp. 700. $7.

Exactly 700 pp. of this book are filled by references to articles on engineering and allied subjects appearing in the technical press of the world during the year 1923. In a sense, the volume may be called a world-wide engineering survey, for these descriptive entries, which in some cases are quite serviceable, concise summaries of articles, when looked over from the viewpoint of subjects treated, space assigned to each main topic and sub-topic, and geographical location of the journal in which the article appears, give a good general idea of the engineering activities of the world during the year covered.

The publication is so well known as to need no description beyond saying that the entries are arranged in a semi-alphabetical or dictionary order; that is, instead of being grouped rigidly by divisions or branches of engineering an alphabetical classification by main subjects is followed with a sub-alphabetical arrangement thereunder. Thus, under concrete or

roads or water treatment will be found the articles dealing primarily with those subjects.

The inherent difficulties of carrying out such an undertaking are made evident here and there by misjudgment in classification and too limited cross-referencing, extensive as the latter is. But to go far in improvement in classification would require the employment of so many specialist indexers as to make it necessary to put an almost prohibitive price upon the index—which by chance this year works out at exactly 1c. a page of index entries.

Finally, it is interesting to note that it is now some forty years since the late Prof. J. B. Johnson started to index engineering periodicals for the journals of the Association of Engineering Societies, the latter having been perhaps the earliest notable attempt at engineering society co-operation in this country.

Cycles that Beget Cycles

REVIEWED BY ROBERT E. HORTON
Consulting Hydraulic Engineer, Albany, N. Y.

GENERATING ECONOMIC CYCLES—By Henry Ludwell Moore, Professor of Political Economy in Columbia University. New York: The Macmillan Co. Cloth; 6x9 in.; pp. 141; 27 diagrams. $3.

The author defines Generating Economic Cycles as "economic cycles which have their origin in non-economic causes and are themselves the originating source of derived economic cycles." The first 68 pp. of the book are devoted to examples set up to prove the existence of an 8-year cycle in rainfall, crop production, prices and economic conditions. The remaining 71 pp. are devoted to the author's theory, or more properly hypothesis, as to the physical origin of the alleged 8-year cycle. A more accurate title for the book would therefore be, An Eight-Year Weather Cycle: Its Consequences and Possible Causes.

Aside from the general interest which attaches to such matters, engineers, particularly hydraulic engineers, are likely to be interested in the existence of a rainfall cycle from the viewpoint of the possibility of predicting in advance periods of rainfall deficiency. Unfortunately the book does not afford much aid to this end. Nevertheless the first section of the book sets forth in a concise, scientific manner, free from mathematical details, the methods and results of the analysis of a variety of data for the determination of the existence of regular periodicity therein. For this purpose the Fourier series and especially the well-known periodogram method of Prof. Arthur Schuster, as extended and simplified by Turner, are utilized.

While some description of these methods appears, it is not sufficiently detailed so that one not previously familiar with the methods could readily follow through the calculations on which the author's diagrams and conclusions are based. The book contains, however, probably more excellent examples of the application of the periodogram method than have elsewhere appeared in any one place. These examples are based mainly on data derived by the author from the work of others and are free from prejudice. The data used are also in general authoritative, including Sauerbeck's index numbers of wholesale prices and Prof. A. J. Henry's data of average rainfall for the United States. To one familiar with advanced statistical methods, the original data and description accompanying them are sufficient so that most of the author's results could be checked *ab initio*. Since Schuster's periodogram method may fairly be said to have had its origin in skepticism, particularly as to the reality of various supposed periodicities, it may be said that the data and methods of analysis used by the author are such that his statistical results are apparently entitled to considerable confidence as such, to say the least. The Schuster periodograms for various classes of data and the diagrams showing the degree of consonance between the original data and the resulting cyclic curves derived therefrom will surely be of interest to anyone who has ever been enticed by the elusive siren of periodicity.

The second and major portion of the book, devoted to the author's hypothesis as to the origin of the alleged 8-year cycle, needs but brief consideration here as it will scarcely be held as of practical utility to engineers, however great its purely scientific interest may be. It deals with such matters as the period of axial revolution of the planet Venus; the relation of the transit of Venus across the sun's disc, to various cosmical and terrestrial phenomena; Birkeland's theory of the aurora, the phenomena of the Crookes' tube, and the like. Some of the material, while no doubt authoritative in its day, appears hardly up to date. In the discussion of the possible relation between sun-spots and terrestrial phenomena there is apparently no mention of some recent excellent work, particularly that of Maunders.

In conclusion it is fair to state that the author nowhere denies the existence of other weather cycles but devotes his attention entirely to the alleged 8-year cycle found by various observers for certain phenomena and extended by him to a variety of additional lines of data.

Municipal Field Reviewed and Indexed

MUNICIPAL INDEX, 1924: A Year Book for City, Town and County Officials and for all Others Interested in Municipal Progress and Public Improvement Activities. New York: The American City Magazine. Cloth; 8 x 10 in.; pp. 407, including advertising. $4.

A well-planned and skilfully executed volume combining concise reviews of municipal government, works and enterprise, with a large and varied amount of advertising of related products and services has been published by the *American City Magazine*. The advertising pages are unusually informative. Some of the advertisements run to many pages and are condensed trade catalogs with numerous illustrations. The type size in the advertising pages is larger than that of the reading pages and the latter are not illustrated. Now and then the well informed reader of the technical articles will feel that if the book was entirely devoid of advertising, some of the products or processes described would perhaps be omitted or that products or materials still in the experimental stages would be more clearly described as such, but on the whole the reading pages are free from advertising influence.

The articles on municipal administration and public improvements and services are divided into seventeen sections. The titles of some of these are: Garbage, Ashes and Rubbish—Collection and Disposal; Motor Trucks; Public Health, etc.; Sewers, etc.; three sections on various phases of streets, including construction, lighting, cleaning and snow removal, and an allied section on Traffic Control; Water Supply and Purification; Municipal Aids from Uncle Sam (bulletins, etc.); and National Organizations Serving Municipalities. At the close of the sections references are made to books and

pamphlets and to articles in the *American City Magazine* on the subjects that have been presented.

The treatment of the distinctively engineering and public-works sections is as comprehensive as could be expected in a book of this plan, especially considering space limitations. The statements are almost all authoritative and are well designed for municipal officials and students of municipal affairs; also for engineers who have not had occasion to specialize in the subjects treated. Some of the activities that are more particularly in the line of civic promotional work have been treated by secretaries or other officials of the leading organization in the fields being covered. There is a well made index to the reading sections, an alphabetical list of advertisers with a statement of the main products or services they offer, and a classified index of the products and services advertised.

Handling Ship Cargoes

CARGO HANDLING AT PORTS: A Survey of the Various Systems in Vogue, with a Consideration of Their Respective Merits —By Brysson Cunningham, D.Sc., M.Inst.C.E., Consulting Engineer; Author of "Dock Engineering," "Harbour Engineering," "The Dock and Harbour Engineer's Reference Book"; Editor of *The Dock and Harbour Authority*; Lecturer on Waterways, Harbours and Docks in the University of London. New York: John Wiley & Sons, Inc. [Aberdeen, Scotland: Aberdeen University Press.] Cloth; 6x9 in.; pp. 180; 124 halftones and line drawings. $3.50.

Literature on the subject of handling cargo to and from ships having been found to be practically nonexistent, the author set about the preparation of this work. In it he has dealt with cargo handling from the point of view of the engineer, making no attempt to cover the field of management and accounting in the limited space of one volume. Mr. Cunningham, as editor of the *Dock and Harbour Authority* and as author of works on docks and harbors, is familiar with his field. This new work will be of special value to persons more or less unfamiliar with cargo handling because considerable attention is given to defining the various terms used in and around ports, including the classification of cargo and cargo carriers, and the processes used there.

Types of pier facilities, cranes and cargo-handling apparatus are described. The equipment of numerous ports on both sides of the Atlantic is illustrated by numerous drawings and photographs. Burtoning, trucking, and lighterage are discussed and considerable attention is given to the methods of handling various types of special cargoes, such as ore and grain.

The appendices give data on the cargo facilities of certain vessels, rates of discharge and loading at certain ports, weights and dimensions of packages commonly handled as general cargo, and cost of handling coal and grain.

Marks' Handbook Revised

MECHANICAL ENGINEERS' HANDBOOK—By Lionel S. Marks, Professor of Mechanical Engineering, Harvard University, and a staff of specialists. Second edition. New York and London: McGraw-Hill Book Co., Inc. Flexible keratine; 5 x 7 in.; pp. 1,986; numerous illustrations and tables; $6.

To provide a handbook which shall reflect the best engineering practice at the beginning of 1924 Prof. Marks has brought out a second edition of the one which he published in 1916. The new edition is larger by 150 pages than the old one. The sections on Hydraulics, Heat, Iron and Steel, Non-Ferrous Metals and Alloys, Bearings, Steam Boilers, Internal Combustion Engines, Aeronautics, and Air Compressors have undergone considerable change. Sections on Drying and Lubrication have been added and the Power Test Codes and similar material are, in most cases, as of Jan. 1, 1924. The first edition was reviewed at length in *Engineering News*, October 19, 1916, p. 747.

French's Engineering Drawing Enlarged

A MANUAL OF ENGINEERING DRAWING FOR STUDENTS AND DRAFTSMEN—By Thomas E. French, M.E., D.Sc., Professor of Engineering Drawing, Ohio State University, M.A.S.M.E., M.S.P.E.E. Third Edition, Revised and Enlarged. New York and London: McGraw-Hill Book Co., Inc. Cloth; 6 x 9 in.; pp. 409; 650 line drawings. $3.

The wide acceptance of this work as a satisfactory text on engineering drawing is attested by the fact that with the present edition the book reaches its 145th thousand. The first edition was reviewed in *Engineering News*, Sept. 14, 1911, and the second was briefly noted in these columns Sept. 19, 1918. In size, the book has been increased from 289 to 310 and now to 409 pages. In the present edition, besides various minor changes, there are three new chapters—on Dimensioning, Perspective (expanded from an earlier note), and Charts, Graphs and Diagrams.

In glancing through the book a sentence was noted that might be given out for criticism in courses on technical writing. It reads, "The starch may be washed from scrap tracing cloth to make penwipers or cloths." Comment on the sentence by a considerable number of students might be worth summarizing.

Electric Elevators

ELECTRIC ELEVATOR EQUIPMENT FOR MODERN BUILDINGS: A Practical Guide to Its Selection, Installation, Operation and Maintenance—By Ronald Grierson, Assoc. M. Inst. E. E., Assoc. M. Inst. M. E., New York: D. Van Nostrand Co. Cloth, 6x9 in.; pp. 179; 96 halftones and line cuts; statistical tables. $5.

Although originally published in England, where, in the opinion of most Americans, the development of the lift has lagged far behind the developments of the elevator in their own country, this work on elevators will be found of value in America because it is a collection of data from scattered sources in both countries, which are not easily accessible. The greater part of the book deals with the mechanical features of elevators—types of cars, shafts, engines, motors, suspension ropes, brakes, control gears, doors, signal systems and safety devices. In addition there are chapters on estimating the service requirements and power consumption on inspection, organization and maintenance, and accidents. There is also a chapter on specifications, and a short one on escalators. The illustrations are numerous and valuable.

PUBLICATIONS RECEIVED

A HISTORY OF INDIAN RAILWAYS issued by the Railway Board, Government of India (Simla, India), is not a review of railway development in India but a statistical history of each of the present lines, with lists of dates of successive extensions and with tabulated records of mileage and financial results. Much space is given to the various agreements and contracts with the government as to land, operation, subsidies, etc. Brief technical information includes track construction, ruling grades and sharpest curves. In this part of the record it is interesting to note the frequent mention of the use of steel and cast iron for ties.

LEADING CITY OFFICIALS in the several thousand municipalities of England, Wales, Scotland, Ireland, Canada, Australia, British Africa, and India, and other British possessions throughout the world are given in The Empire Municipal Directory and Year Book, 1924-25 (London: Sanitary Publishing Co.; 11s. in England). The names of the city clerk and heads of the health and various engineering and municipal works departments are given. Populations are included. A new feature in this Year Book is announced by way of officials of principal foreign cities of the world, but the list includes only thirty in all with but five in the United States. Besides the directory feature, current practice in various classes of public works is reviewed and information given regarding a considerable number of municipal and other societies. Recent British statutes and departmental orders are given; also digests of decisions of higher courts.

A FIFTH VOLUME of the Port Series has been issued by the Board of Engineers for Rivers and Harbors, War Department and the Research Bureau, U. S. Shipping Board. As in the case of the preceding volumes this one gives complete data concerning the physical features, port services, fuel, railroad connections, and foreign and domestic commerce of the port; in this case New Orleans, La. There is also a discussion of the origin and destination of the business handled by the Mississippi-Warrior River Barge line, as well as of the railroad rates applying to the Gulf ports in general. The other volumes of the series cover the ports of Portland, Me.; Boston, Mass.; Mobile, Ala.; Pensacola, Fla.; and Philadelphia, Pa. (Washington, D. C., Superintendent of Documents: 75c. each.)

A WIDE RANGE OF INFORMATION about Australia, its states, cities, railways and other industries, its vital and meteorological statistics, etc., is given in the Official Year Book of the Commonwealth of Australia (Melbourne: Bureau of Census and Statistics, Charles H. Wickens, Commonwealth statistician; John Stonham, editor; 1122 pp.).

AN ECONOMIC SURVEY of Argentina, Paraguay and Uruguay in the form of a 54-p. descriptive and statistical pamphlet has been published by the Commission on Commerce and Marine of the American Bankers Association (Chairman, Fred I. Kent, vice-president, Bankers Trust Co., New York City).

GOITER PREVENTION by treating water supplies with sodium iodide is reviewed briefly in reprint No. 893, *Public Health Reports*, entitled Methods of Administering Iodine for Prophylaxis of Endemic Goiter, by Robert Olesen, surgeon, U.S.P.H.S. (Washington, D. C.: Superintendent of Documents; 5c.) Twenty-four general articles on the subject are passed in brief review. Iodized chocolate tablets are characterized as "the most favored" of "numerous methods of supplying iodine for the prevention of endemic goiter." Iodized table salt is said to give "considerable promise as an efficient means of preventing endemic goiter in a wholesale manner." On water supply treatment, Doctor Olesen has this to say: "The wholesale iodization of a municipal water supply may be cited as an ingenious method in need of further appraisal before a definite verdict as to its efficiency can be given."

SOME UTILITY RATE PROBLEMS with particular attention to water rates are discussed in a paper entitled "The Reasonableness and Equity of Service and Minimum Charges by Morris Knowles and Nathan B. Jacobs (Pittsburgh, Pa.) before the Pennsylvania Water-Works Association last October and now available in pamphlet form. A number of utility commission and court decisions are briefly reviewed and a considerable list of references is given.

TESTS OF MARINE BOILERS is the subject of a 309-p. bulletin of the Bureau of Mines by Henry Kreisinger and five others. (Washington, D. C.; Superintendent of Documents; 55c.; limited number of free copies available.) Tests of two marine water tube boilers and of one Scotch marine boiler are given. The authors state that they could not find anywhere published comparative tests of boilers of these two types of nearly the same capacities made by the same organization and by the same methods.

RECENT ADDITIONS to pamphlets and reports on city planning and zoning include: A Standard State Zoning Enabling Act by the Advisory Committee on Zoning, U. S. Department of Commerce (Washington, D. C.; 5c., from Superintendent of Documents), previously issued in mimeographed form; What Planning Has Done for Cities, by George B. Ford, president, National Conference on City Planning; and also annual reports of Planning Board, Somerville, Mass., including a preliminary survey and program for a city plan, the latter by the Technical Advisory Corporation (for either pamphlet address Mr. Ford, 15 Park Row, New York City). Survey of City and Regional Planning in the United States, 1923, by Theodora Kimball, librarian, School of Landscape Architecture, Harvard University, Cambridge, Mass. (reprinted from *Landscape Architecture*, January, 1924).

SWIMMING-POOL STANDARDS by Arthur M. Crane of the New York Continental Jewell Filtration Co., Nutley, N. J., is one of a number of papers in the 1924 Proceedings of the Journal of the American Association for Promoting Hygiene in Public Baths. Mr. Crane is treasurer of the association. A summary of the status of state regulation of public baths, swimming pools, etc., arranged alphabetically by states is given in the pamphlet, and the actual regulations formulated in California, Colorado, District of Columbia, Idaho, Nebraska, Oklahoma, the Philippines, South Dakota, Utah and Wyoming, are reprinted. Among the papers is one on public baths in Jersey City by H. A. Kelly, engineer and architect, Department of Parks, Jersey City, and one on a practical method for the chlorination of water in bathing beaches by Majors W. P. Baker and Paul E. McNabb, Medical Corps, U. S. A.

CHANGES IN THE FEDERAL INCOME TAX (1924 compared with 1921) are shown in a digest of four large printed pages prepared by W. B. Swindell, Jr., economist, and Bertha L. Holmes, Washington manager of the staff of Archibald Harris & Co., Marquette Bldg., Chicago (under the direction of H. Archibald Harris). Copies may be had free on application.

New Books and Revised Editions

[Those desiring copies of the books listed below or mentioned elsewhere in this section should order them from the publishers or from their local booksellers.]

THE ELECTRIC MOTOR TRUCK: Selection of Motor Vehicle Equipment, Its Operation and Maintenance—By Edward E. La Schum, General Superintendent, Motor Vehicle Equipment, American Railway Express; M. Soc. Automotive Engineers. New York: U. P. C. Book Co., Inc. Cloth; 6 x 9 in.; pp. 307; 131 halftones and line cuts including record charts. $4.

AN INTRODUCTION TO THE MATHEMATICAL ANALYSIS OF STATISTICS—By C. H. Forsyth, Assistant Professor of Mathematics, Dartmouth College. New York: John Wiley & Sons, Inc.; London: Chapman & Hall, Ltd. Cloth; 6 x 9 in.; pp. 241. $2.25.

INVENTOR'S MANUAL: How to Work a Patent to Make It Pay—By George M. Hopkins, Experienced Inventor; Revised by A. A. Hopkins, M. Am. Statistical Assoc. [Third Edition, Revised and Enlarged.] New York: The Norman W. Henley Publishing Co. Cloth; 5 x 8 in.; pp. 138; samples of mechanical and design patent drawings; tables. $1.50.

POPULAR RESEARCH NARRATIVES: Fifty five-minute stories of research, invention or discovery, directly from the "men who did it," pithily told in language for laymen, young and old—Collected by the Engineering Foundation. Baltimore, Md.: Williams & Wilkins Co. Cloth; 5 x 8 in.; pp. 152. 50c.

RUSSIAN DEBTS AND RUSSIAN RECONSTRUCTION: A Study of the Relation of Russia's Foreign Debts to Her Economic Recovery—By Leo Pasvolsky and Harold G. Moulton, with the aid of the Council and Staff of the Institute of Economics. [The Institute of Economics Series.] New York and London: McGraw-Hill Book Co., Inc. Cloth; 5 x 8 in.; pp. 247; $2.50.

SCHOOL BONDS—By John Guy Fowlkes, Ph.D., Associate Professor of Education, University of Wisconsin. Milwaukee, Wis.: The Bruce Publishing Co. Cloth; 6 x 9 in.; pp. 176; inserts of bond forms.

3,700 SPLAY BASES AND OTHER CALCULATIONS (Priddle's Tables): For Contractors and Quantity Surveyors—By Arthur Priddle. San Francisco: The Author. Loose-leaf binding, fabrikoid or leather; 7 x 9 in.; pp. 66. $3.50 in fabrikoid, $5.50 in leather, postpaid.

TAXATION: The People's Business—By Andrew W. Mellon. New York: The Macmillan Co. Cloth; 5 x 8 in.; pp. 229; statistical tables. $1.25.

Letters to the Editor

This department aims to be a forum for the discussion of the views of engineers and contractors. The range of interest should be as wide as possible. Contributors are, therefore, asked to make their letters short.

Reciprocity Provided For in State License Laws

Sir—With regard to Clemens Herschel's letter on licensing in *Engineering News-Record* of June 5, p. 988, I would like to take exception to some statements made by him.

He says, "Some license states extend the privilege of practicing in them to an engineer licensed in any state; more do not." To June, 1923, there were 26 states having license laws. Of these, 19 grant the privilege of practicing to licensed engineers or land surveyors of other states, and 7 do not. Of the 7 that do not, only two (Alabama and Nevada) have license laws covering engineering. One (Wyoming) has a law covering both engineering and surveying; and four (California, New Mexico, South Dakota and Texas) have laws covering land surveying only. Thus there are only three states that do not give the privilege to licensed engineers of other states. So why should Mr. Herschel make the statement that it would cost $700 for a license to practice throughout the United States?

I would also like to ask why, with the requirements given in the present law, the state board of license would have to give a certificate to anyone applying for it and paying the necessary fee if he did not come up to the standard set by the law as now in force.

H. R. HORTON,
Licensed Land Surveyor.

Massena, N. Y., June 9.

Sir—Mr. Herschel's letter of May 14, against licensing engineers, pub'ished in your issue of June 5, proves once more the distressing fact that even engineers are apt to reach conclusions based on either incorrect or insufficient knowledge of the subject.

If Mr. Herschel knew of the work that has been done by the National Council of State Boards of Engineering Examiners, he would not have said that it would take six months for an engineer to qualify in states having license laws. Under the agreement framed by the council and adopted by some twelve states, it would take, for instance, about five minutes for an engineer holding a Michigan reciprocity license card to qualify in Louisiana, and vice versa. The reciprocity card can be obtained by an engineer who can qualify at any meeting of the state boards that have approved the agreement.

Mr Herschel's astonishing statement that "existing laws began as the consequence of petitions conceived by certain office draftsmen in a trade union spirit" is also greatly at variance with the facts. Louisiana framed its first law in 1908 and it was conceived by some of its ablest practicing consulting engineers; the same holds true of a good many other states, notably Michigan, Florida, Indiana, Iowa, Colorado, Oregon, North Carolina and others.

The suggested plan of substituting the national societies for the license laws would be a discriminatory measure and probably stand the constitutional test with less chance of success than the present laws.

MARCEL GARSAUD,
Consulting Engineer.

New Orleans, La., June 12.

Sir—I have read with interest the letter of Clemens Herschel of May 14, published in your June 5 issue and in reply thereto state that he has the wrong point of view. I fail to understand why the selection for the competency of engineers should be left to an engineering society. There are a great number of men who are not members of any society and in my opinion are as competent as those who belong to national societies.

There will be a reciprocity agreement arranged between the various states and when that method is completely worked out it will not become necessary for engineers to pay fees in every state. They will simply file notice that they hold a license, and that will be sufficient for any board in the United States.

Many men will continue to protest at licensing, which is not yet perfect and will not be for a number of years. It has a good start and can be modified from time to time by the proper authorities, and by those people who are willing to aid and assist the engineers for a better result. If there are many engineers who object to particular items of the law for the licensing of engineers, the various boards throughout the country would be willing to listen to reason and help modify the laws. The law may not have enough teeth to chew up the evils of the engineering profession, but the future will take care of itself and accomplish all that is looked for by the professional engineer.

I had a great deal to do with the licensing law in this particular state, and know that it was with difficulty that we were able to have enacted the law as it reads today, no matter how imperfect it is. Let us amend until everybody is satisfied. This law was not put over by a group of draftsmen and union leaders but by such men as Col. Walter G. Elliott, former park commissioner of the city of New York, the late Major John A. Bensel, former president of the American Society of Civil Engineers and state engineer. The law was put on our statute books for the benefit of the engineers and not for any particular society. The present board of engineer examiners of the state of New York is made up of one member from each of our national societies, and the various states of the union have used this same scheme in selecting the members for their boards.

New York, June 11.

DAVID M. OLTARSH,
Consulting Engineer.

Pump Types and Pipe Breaks

Sir—The question raised by George H. Fenkell in your issue of April 24, p. 737, "Has the Type of Pump Anything to do with Pipe Breaks?" can be sensibly reversed to read: "Has the Type of Concussion in Pipes Anything to do with Pump Breaks?"

The experience of the late Mr. Brush at Hackensack, N. J., is in evidence. Trouble in a large force main many miles from the station wrecked a pump in that station. The circumstances were such that no doubt existed as to the fact nor as to the good design and good quality of the pump. Under like conditions any pump might have failed. In general, breaks in force mains are due to weakness of a nature that should not obtain to the extent that a difference in the kind of pump would result in fracture. If such weakness exists in the distribution system of an average city it is better to find it out with a pump than by the fire department. The inertia and friction of moving parts in any pump tend to lessen the flow of water through a sudden break or the use of a large connection.

When a standpipe or tank at a distance from the pumping station, as on the opposite side of a city, is in use the concussion from the opening and closing of fixtures is greater than when the standpipe or reservoir is not in use. And again we are reminded that approved specifications for cast-iron pipe set out the least factor of safety for the larger pipes; that is, the factor is greater for 12- than for 16-in. pipe and so on, although breaks in the large pipes are more difficult to repair and may be expected to cause greater damage.

H. F. D.

New York City, May 6, 1924.

Indian Engineers Active in Government

Engineers have responsible positions in the reorganization of the railway department of the Government of India, the technical branches having been put in charge of two directors, consisting of the chief engineer and the chief mechanical engineer. The term Railway Board will be retained for the headquarters organization, which will comprise a chief commissioner, a financial commissioner, and two commissioners for technical and general matters.

News of the Week

CURRENT EVENTS IN THE CIVIL ENGINEERING AND CONTRACTING FIELDS

H. M. Swetland, Business Publisher, Dies

Was Pioneer of Modern Industrial Publishing—Was President of United Publishers

H. M. Swetland, president of the United Publishers Corporation, which publishes *Iron Age, Dry Goods Economist, Automotive Industries* and other important business publications, died at his home in Upper Montclair, N. J., June 15. He was one of the pioneers of modern industrial publishing and had been a leader in raising journalistic standards through his activities in the Associated Business Papers. At one time he was owner of *Power* and of *Engineering & Mining Journal* (as it was then called), both now owned by the McGraw-Hill Co.

Mr. Swetland was born in Chautauqua County, New York, in 1853. In 1880 he came to New York as reporter and as subscription and advertising salesman of the *Boston Journal of Commerce*. In 1884 he became Boston representative of *Power*, later coming to New York and assuming the management of that publication. In this capacity, he was associated with James H. McGraw, now president of the McGraw-Hill Co., and Emerson P. Harris. The association was discontinued in 1888 when Mr. Swetland purchased *Power*, the ownership of which he retained until he sold it to the late John A. Hill in 1900.

For many years thereafter, Mr. Swetland gave his chief attention to the publication of the magazines serving the automotive industry. In 1911 he organized the United Publishers Corporation, which brought together publications in the steel, automotive, building and textile fields. He was elected president of that corporation and retained that office to the time of his death. He was also president of the National Publishers Association, the Class Journal Co., the Federal Printing Co., the U. P. C. Realty Co., and the Swetland Realty Co., and a director of the Commercial Trust Co.

Mr. McGraw Pays Tribute

Mr. Swetland's work and contribution to industrial publishing are well set forth in the following tribute paid to him by his life-long friend and former associate, Mr. McGraw:

"Mr. Swetland's success as a man and a publisher was due to a rare combination of personal qualities and business acumen. He was a tireless worker, had great penetration, concentration, and perseverance. He was an organizer of the first rank, and was always a co-operator. His ideals in publishing were high, service to the readers of his publications being his first consideration. The publishing business has lost an outstanding figure in the passing of Horace M. Swetland, but his work will endure in the great institutions to which he gave unstinted devotion, and in the lives of those whom he trained in the technique of publishing and encouraged to make the best of their opportunities."

Mr. Swetland not alone won for himself marked distinction in American technical journalism and in those industries which his papers served, but —what he prized more—the high regard and respect of all his very wide circle of associates, business and social. To these, his passing brings a keen regret.

Contractor Wins Heavy Damages From Sewerage Commission

After hearing argument over a period of 28 days, a jury in the U. S. District Court at Trenton, N. J., on June 10 awarded Holbrook, Cabot & Rollins, a New York contracting firm, the sum of $765,422 as reasonable damages sought by that firm in its suit against the Passaic Valley Sewerage Commission. The suit grew out of the allegation that excessive damages had been sustained by the contractor as extra costs in the construction of a tunnel for the commission's trunk sewer near Bayonne, N. J. The plaintiff's ground for action was based on the charge that borings misrepresented the true character of excavation encountered. The contractor had sought to recover $800,000.

License Issued for Power Sites on the Tallapoosa River

A license covering five power sites on the Tallapoosa River has been authorized by the Federal Power Commission in favor of the Alabama Interstate Power Co. The original plans of the company for the development of the river above Cherokee Bluffs called for three dams. More recent studies revealed the fact that five dams should be constructed, and as the Alabama Public Service Commission has so far not issued certificates of convenience and necessity covering these two additional sites, a condition has been included in the license to protect the state rights.

The completion of these five power developments and their operation in connection with the Cherokee Bluffs plant will make possible the fullest practical use of the power resources of the stream. The combined installed capacity of the new plants will be 114,000 hp.

Freeman Gives Am. Soc. C. E. $25,000 Research Fund

Board of Direction Accepts Offer of Society Past President—New Technical Division Formed

Engineering News-Record Staff Report

The Board of Direction of the American Society of Civil Engineers, meeting in Pasadena, Calif., June 16 and 17 prior to the opening of the fifty-fourth annual convention accepted an offer from John R. Freeman of a fund of $25,000 to be used in encouraging young engineers in research work, amended and adopted the local sections conference plan, and decided to publish details of the Beach-Sherrill matter relating to civilian control of federal non-military engineering work.

The Freeman fund, while designed primarily to encourage research, may be expended for translations, scholarships or the publication of books or papers, whenever advance of engineering knowledge, particularly hydraulic engineering, may thereby be promoted. The testimony of General Beach and Colonel Sherrill before the joint congressional committee on government department reorganization together with the board's comment thereon is to be published in the society's *Proceedings*.

Local Sections Plan

The conference of local sections at annual meetings in addition to being a forum for the discussion of ideas on section work is to afford the section opportunity to participate in planning technical division activities and is also to be a direct means of disseminating among the membership word of current society plans. It was announced that through the co-operation of Engineering Foundation there is available $2,500 for this year's work of the committee on steel column research and $3,150 for the committee on concrete and reinforced-concrete arches.

Two new student chapters were authorized, bringing the total number to 70.

The board approved the plan for co-ordinating the activities of local chapters of founder societies as submitted by the joint conference committee, authorized a waterways division (the seventh technical division to be formed) and authorized the president and the secretary to take such measures as may be necessary to protect the society from the confusion of names likely to arise by a new organization by the name of American Society of Engineers.

The Detroit meeting was set for Oct. 23-25, and the main subject for discussion will be the St. Lawrence deep waterway problem with the principal paper by Francis C. Shenehon, consulting engineer.

Surety Company Officials Meet Contractors

Committees Appointed to Report On Means To Eliminate Irresponsibles

Steps of national importance looking to the elimination of the irresponsible contractor through the co-operative action of surety companies, public officials and contractors' organizations were taken June 7 when nationally prominent public works officials, officials of surety companies, and representatives of the Associated General Contractors of America and of the American Association of State Highway Officials met with Secretary of Commerce Hoover at the Department of Commerce.

The Associated General Contractors were responsible for the conference. That organization is seeking to find some plan whereby the industry, with the co-operation of surety companies and public works officials, might devise some plan whereby to eliminate the incompetent, irresponsible official contractor. Benefits from such an action, it was p inted out, would be derived through the elimination of losses to the surety companies, of hazards caused to the more responsible contractor and to the state governments.

Recommendations Made

Methods of surety companies in their investigations before underwriting were described as lacking an adequate system in many cases, and several speakers urged the establishment of a credit rating system. It was revealed that there is a committee of surety companies which is working toward a closer understanding as to the process of classification and ratings under such classifications but that this work is not necessarily a credit rating system alone.

The action taken included a resolution favoring the elimination of the bid bond on contracts and the sureties consent. Discussion of this brought out a sentiment in favor of the use of securities like liberty bonds.

Another action taken was adoption of a resolution that all contractors should furnish full and accurate information at the time of making application for surety bonds both as to their financial standing, experience and contingent liability from work on hand, and that none of this information should be more than six months old. Discussion of this showed an agreement that in the bonding of a contractor, experience should be the most important factor, and that the next should be his equipment, its amount and condition, while the third should be the financial condition.

An important contribution to the discussion was information given by state highway officials as to the contractors who bid in their various states.

A further action was to refer to a committee of three to be appointed by the chairman the improvement of methods of ascertaining credit information, the committee being charged with working out a better method than now obtains.

Another committee of three was ordered by the meeting to survey the present practice of surety companies in giving free service in engineering information and estimates. Discussion of this brought out a wide variance of opinion as to the value of present practices in this direction.

Practice of certain agents splitting commissions with the contractor was denounced by representatives of the agents organization as hampering the efficiency of a large body of men who are giving honest service to both their companies and their clients.

The meeting referred to committees problems of other forms of securities, uniform enforcement of the time penalty and the publication of the name of surety companies on each security bond.

It was decided that these committees would have had time to complete their studies to a point where a report might be made at a meeting to be held late in September.

Among the 29 who attended the conference were: H. C. Badgerow, vice-president, Continental Casualty Co. and chairman of committee of the Surety Association of America; F. L. Cranford, president, Associated General Contractors of America, and of F. L. Cranford, Inc., Brooklyn, New York, J. H. Cranford, president, American Road Builders Association, and of Cranford Co., Inc., Washington, D. C.; Ernest Greenwood, correspondent, Department of Commerce; R. C. Marshall, Jr., general manager, Associated General Contractors of America and chairman, joint conference; W. R. Neel, state highway engineer, Georgia; and chairman of committee of the American Association of State Highway Officials; H. H. Wilson, Winston & Co., Harrisburg, Pa.; and chairman of the committee of the A. G. C.; and P. St. J. Wilson, chief engineer, U. S. Bureau of Public Roads.

The committees appointed and the subjects assigned to them were as follows:

Committee No. 1—E. A. St. John, president, National Surety Co., chairman; W. H. Connell, Deputy Commissioner of Highways, Pennsylvania, and H. H. Wilson, Winston & Co. Subjects: (A) risk or credit bureau for ascertaining responsibility of contractors; and (B) free service of surety companies—estimating, engineering advice, bidding information, etc.

Committee No. 2—F. L. Cranford, chairman; F. A. Bach, vice-president, Fidelity & Deposit Co.; and W. R. Neel state highway engineer, Georgia. Subjects: (A) qualifications of contractors and financial statements; (B) progress reports of construction; (C) uniform contracts for construction; and (D) day labor construction.

Committee No. 3—P. St. J. Wilson, chairman; L. C. Wason, Aberthaw Construction Co., and E. W. Bush, Engineer, Aetna Casualty & Surety Co. Subjects: (A) forms of surety other than the corporate surety bond; (B) uniform enforcement of time penalty in construction contracts; and (C) publication of name of surety on each construction contract.

Willamette Bridge Contract Let

Contract for construction of a bridge across the Willamette River at Harrisburg, Ore., was let by the Oregon State Highway Commission, on May 31, to the Portland Bridge Co. for $183,200. The ten other bids received ranged from $186,400 to $237,115. The bridge, which replaces a ferry, will consist of three 180-ft. steel spans, with ¼ mile of timber trestle approach. The roadway width on the structure will be 24 ft.

Commissioners Void Portland Bridge Contracts

Following recall of the Board of County Commissioners of Multnomah County, Ore., which two months ago awarded contracts for the construction of three new Portland bridges (Burnside, Ross Island, and Sellwood), the new commissioners on May 26 voided the contracts for these three bridges, on the ground that the contracts were unreasonably high and not within the bond issue, so that the obligation which they created was unconstitutional. They also described the contracts as unlawfully collusive. The contracts were with J. H. Tillman for the Burnside bridge, Parker & Banfield for the Ross Island bridge, and the Union Bridge Co. for the Sellwood bridge. The letting of contracts for construction and for engineering services in connection with these bridges recently brought about indictments of contractors, engineers, and county commissioners, as noted in *Engineering News-Record* of April 24, p. 740, May 15, p. 873 and June 12, p. 1036.

Reporting on the legal status of the contracts for engineering and architectural services in connection with these bridges, the district attorney rendered an opinion to the board which stated that the contracts with Houghtaling & Dougan for architectural services and with the Strauss Bascule Bridge Co. for designs and patent rights "cannot be treated otherwise than as valid contracts with the county." The contract for engineering services with Hedrick & Kremers is still under consideration as to its validity. R. E. Kremers, of the firm, is one of the men indicted for bribery of a county official.

Work to Be Started on Forsyth Crossing Elimination

Under an order of the New York State Public Service Commission, actual construction of the overhead bridge for the elimination of the Forsyth crossing in Chautauqua County can now be started. The commission directed the construction of an overhead crossing in June, 1922, but the railroad company did not approve of the plans as then prepared on account of the limitation which the bridge abutments would put upon their right-of-way and appealed the decision of the court which upheld the Public Service Commission. The commission has now approved the plans which give the railroad an unrestricted right-of-way with the understanding that the question of cost of the extension will not be allowed to delay construction.

Harold Almert Elected A. A. E. President

Chicago Consulting Engineer Is Named at Society's Annual Convention in San Francisco

Harold Almert, consulting engineer of Chicago and a charter member of the American Association of Engineers, as well as one of its earliest directors, was elected president of the association at the annual convention held last week in San Francisco. The other officers elected were: Morris Bien, assistant commissioner, U. S. Reclamation Bureau, Washington, D. C., first vice-president; Edmund J. Fitzmaurice, consulting engineer, Philadelphia, second vice-president; and Donald M. Baker, Charles J. Ullrich, E. B. Rhine, Harry G. Culverhouse, Allen M. Knowles, E. I. Gardiner and A. Richards, directors.

Selection of the 1925 convention city was left to the board of directors, the convention by roll-call vote expressing preference for Orlando, Fla.

Mr. Almert has long been identified with professional society activities. He has been engaged in private consulting practice since 1914. Prior to that time he spent five years in utility operation and five in construction work. He was born in Chicago in 1876 and after taking manual training and eight years' study of mechanical and electrical engineering taught physics and elements of electricity for eighteen months, after which he entered public utility service.

Besides serving on various committees of the association, he represented the Chicago chapter with the transportation committee of the Chicago City Council in studying the traction and traffic problems of that district. He is now a member of the committee on public improvements and tax rate, chairman of the committee on permanent fund, and member of the committee on insurance. At the present time he is retained yearly by fourteen of the larger Chicago banks and mortgage houses as technical counsel.

Copco Power Plant No. 2 Started

The California Oregon Power Co. has just started construction on Copco No. 2, a hydro-electric plant about a mile downstream from the Copco No. 1 plant now in operation on the Klamath River, California. The new plant will have a capacity of 30,000 kva. and will contain two 20,000-hp. vertical reaction waterwheels operating under a head of 166 ft.

The new plant is to be served by water taken from the stream bed below the upper plant by a small concrete dam which will divert the flow into a combined tunnel and flow line, including, in addition to the penstocks proper, two 16-ft. tunnels totaling 3,745 ft. in length and 1,200 ft. of creosoted wood stove pipe 15 ft. in diameter.

Cook County Research Survey of Roads Approved

Agreement was reached June 4 between Cook County, Illinois, and the Bureau of Public Roads for a joint research survey of "highway transportation on the Cook County highway system, during July, August, September and October, and such additional physical investigations of pavement and subgrade coming within the scope of this investigation as it is mutually agreed upon to conduct. The purpose is to secure and develop facts and principals which will aid in the planning and construction of the most economical and serviceable highways in the area around Chicago, the best design of highways to meet traffic requirements and to further advance the science of highway development."

The Bureau of Public Roads furnishes the supervisory personnel and such equipment as it has available. The county will furnish scales, trucks and assistants. Certain other costs are to be shared equally; the total estimate of cost is $18,000. The largest item is for salaries as follows: Field manager at $3,000 per annum, five party chiefs at $2,200 each per annum and fourteen recorders at $1,500 each per annum.

Cook County is paying about one-third of the cost of roads being constructed under the $60,000,000 bond issue and has received about 2 per cent of the bond issue pavements. Under the $100,000,000 proposed issue to be voted on in November only a comparatively small mileage is planned for Cook County. This survey, the first of its kind in Illinois, will provide a scientific basis for the allocation of roads, types and widths within its scope.

George A. Quinlan, county highway superintendent, carried on the negotiations with Thomas H. MacDonald, chief, Bureau of Public Roads, which led to the agreement.

Southern Pacific to Build New Line in Southwest

Under the agreement whereby the control of the El Paso & Southwestern R.R. passes to the Southern Pacific, the latter road plans to build approximately 130 miles of railroad in Arizona to put Phoenix on the main line of the Southern Pacific. The part of the agreement which concerns the new construction reads as follows:

"The Southern Pacific Co. will take steps immediately when approval is obtained to construct and to complete within a period of two years a main line railroad through the city of Phoenix, Ariz., from a point at or near Red Rock or Picacho northerly through the Casa Grande Valley irrigation project connecting with the Phoenix & Eastern at or near Magma Junction or Florence, whose line from such a connection through Phoenix, together with the Arizona Eastern Line from Phoenix to Hassayampa, will be brought up to main line standards and will be connected by new construction with the main line of the Southern Pacific at some point between Colfred, Ariz., and Indio, Calif."

Mid-West Road Officials Welcome Latin-Americans

County, City and Park Officials Meet Touring Delegation at Chicago—Three Days in Illinois

When the Pan-American Highway Commission, now inspecting roads in the Middle West, reached Chicago by automobile from Springfield, it was met at the Cook County boundary by a delegation of county, city and park officials. The Commission was tendered a dinner by the Chicago Association of Commerce at the Drake Hotel, attended by 150 business men, engineers, representation of road equipment and materials, automobile and truck companies.

Mayor Dever welcomed the delegates. John J. Sloan, president of the Board of Local Improvements, told how Chicago builds 100 miles of paving annually. George A. Quinlan, county highway superintendent, spoke of the traffic survey just initiated, to be carried out jointly by the Bureau of Public Roads and Cook County; William G. Edens, vice-president, Central Trust Co. and father of the good roads movement in Illinois, paid a tribute to three road men present, Thomas H. MacDonald, chief, Bureau of Public Roads, Frank T. Sheets, state highway engineer and George A. Quinlan, Cook county highway superintendent.

G. A. Sherwell, secretary general, Inter-American High Commission, translated into Spanish each of the speeches, and Hector Vigil, editor of "Road and Touring," the official magazine of the automobile clubs of Valparaiso and Santiago, Chile, responded for the delegation.

Visit Chicago Parks

A drive around the park system of Chicago was arranged by Col. A. A. Sprague, commissioner of public works.

The delegates spent three days in Illinois being driven from Springfield to Chicago by arrangement of Frank T. Sheets, state highway engineer. A breakfast was given the delegates by Governor Small at Springfield and another at Aurora by road equipment companies.

In Minnesota, C. M. Babcock, commissioner of highways, and J. H. Mullen, chief engineer highway department, arranged a trip from St. Paul to the Iron Range thence to Duluth. In Wisconsin, A. R. Hirst, state highway engineer arranged to pilot the party from Madison to Lake Geneva. Next week the commission will inspect the automobile industry at Detroit and the rubber industry at Akron.

Shoals Legislation Goes Over

Disposition of the government-owned property at Muscle Shoals has again been put over until another session of Congress. During the closing hours of the last session, which ended June 7, sentiment in Washington had swung from legislation proposing to accept the Ford offer to that which would retain the government as the operator of the property.

Tucson Engineers Protest Change in Reclamation Titles

The Tucson chapter of the American Association of Engineers has passed a resolution protesting against the change, in the Reclamation Bureau, of the title "project" manager to "superintendent of ditches." The text of the resolution follows:

"WHEREAS, in a recent reorganization of the United States Bureau of Reclamation, the office of project manager has been abandoned, leaving the various projects without any responsible heads and making it necessary for the people of each project to deal with distant officers, and

"WHEREAS, the project managers, most of whom have rendered long and faithful service to the Reclamation Service and to the local projects, have been demoted by having most of their duties and responsibilities taken from them, and are now to be called Superintendents of Ditches, which implies that their duties will be those heretofore rendered by younger men called superintendents of irrigation, and

"WHEREAS, much of the success of many splendid reclamation projects in the West has b en due to the conscientious, efficient, and self-sacrificing administration of the project managers,

"BE IT RESOLVED, That the Tucson Chapter of the A.A.E. hereby registers its protest against the division of authority and of responsibility at the project offices and against the demotion of those members of our profession who have served as project managers,—not only because of the injustice to those men, but also because we believe the effect at the project offices will have a demoralizing tendency; and

"BE IT FURTHER RESOLVED, That copies of this resolution be sent to the Secretary of the American Association of Engineers, to the president of the Arizona division of the A.A.E., and to others."

Ask for Joint Study of Bay of Fundy Power Project

The Federal Power Commission has asked the State Department to suggest to the Canadian Government that it join with the United States in referring the application of Dexter P. Cooper for a preliminary permit covering a tidal power project in the Bay of Fundy to the International Joint Commission for investigation, report, and recommendation. Mr. Cooper proposes to erect a series of dams across the channels between the islands which separate Passamaquoddy Bay and Head Harbor from the Bay of Fundy, thereby creating two pools for the development of power by taking advantage of the wide range of the tide in the Bay of Fundy.

The engineers of the Federal Power Commission have some doubt as to the feasibility of the project, but feel that on account of its magnitude and the interest in the matter of developing power from tides a further investigation by the International Joint Commission is warranted. On account of the international character of the Bay of Fundy any definite action on the part of the Federal Power Commission is impossible and the International Joint Commission must deal with it.

Favors Potomac Development By Private Capital

Opposition to government development of the power sites on the Potomac near Washington developed at the hearing before the District of Columbia Committee of the House of Representatives at a recent hearing. Col. William Kelly, chief engineer of the Federal Power Commission, indicated that this is a particularly propitious time to make this development as a new steam plant has been brought into service in Washington and the development of the Chain Bridge site on the Potomac would provide additional hydro-electric power by the time more was needed, thus avoiding the need for constructing more steam plants in Washington. Moreover, on account of the size of the pool at the Chain Bridge site a power plant located there would be able to handle large peak loads.

Engineers Dedicate Memphis Zero Milestone

The zero milestone for the city of Memphis, Tenn., presented to the city by the Engineers' Club of Memphis, was recently dedicated with appropriate services. The idea of presenting this monument to the city was originated in 1923 by C. C. Pashby, president of the club. The stone was designed by B. S. Cairns, member of the committee, and consists of a block of native Tennessee marble upon the top of which is a bronze marker with a conical center which is noted as the point from which distances are to be measured. On the rear of the stone is carved the elevation above sea level. The stone was located by the Engineers' Club committee, the City Planning Commission, and the Memphis City Engineering Department.

Bonus System Inaugurated on Moffat Tunnel

To speed up the work at the Moffat tunnel the engineers have decided to put in effect a bonus system, the bonus to begin on an average of over 17 ft. a day, over a 15-day period, and is graduated above 17 ft. in proportion to the wages received by each man on the work. To secure the bonus a man must work his tour unless excused by the superintendent. It applies to the men engaged in the headings of the water tunnel, the cross-cuts and the main headings of the railroad tunnel. Chief Engineer Keays has placed the base progress at 510 ft. per month, bonus to be paid in excess as follows:

Group No. 1: assistant superintendends, shifters, scalers, miners, helpers, and nippers, 15c. up to 600 ft.; 20c. a foot between 600 and 675 ft.; 30c. for 675 ft. and up.

Group No. 2: mucking-machine operators and muckers in the crew of the mucking machine, 10c. up to 600 ft.; 12c. from 600 to 675 ft.; 18c. for 675 ft. and up.

Group No. 3: tunnel motormen and brakemen engaged in hauling from water tunnel headings only, 5c. a foot up to 600 ft.; 7c. from 600 to 675 ft.; 10c. for 675 ft. and up.

Random Lines

Thanks For the Ad!

"When there are vacancies in the public service, local A. A. E. Chapters could offer their services to the official whose duty it is to make the selection. Often officials are glad to have this help because it relieves them of making personal selections which might offend. Naturally in some cases more can be accomplished by working quietly than could be by publicity, *but the recent appointment of a head of the reclamation service shows the value of publicity in some cases.*" — From the report of the A. A. E. Committee on Services and Salaries of Engineers in Public Service.

* * *

Tyler Hewett Bennett
Economist and Estate Engineer
requests the honor of your consultation with
his organization
to perfect plans to protect your
family in their handling of your estate.
501 *Fifth Avenue, New York*

* * *

Another Pi Mnemonic

Sir—In looking over some of the numbers of your paper I find under "Random Lines," March 13, p. 466, a reference to a mnemonic for the value of π which would be less open to your criticism if "brains" were singular, and if the word "sometimes" read "sometime."

Some years ago the *Literary Digest* published various rhymes, not only in English but also in French and in German, which were quite clever attempts, though it would seem the difficulty of such composition is too great to enable smooth flowing lines to be composed.

Disregarding the matter of rhyme, the writer attempted to compose a mnemonic for the value of π, a copy of which is given below. This will enable a person to memorize the value of π until the first zero in the decimal is encountered, in the thirty-second place.

"For π must a whole multitude of digits stand for exact relation. Recollect, ancient precision now is far exceeded. What suited in former ages may not occasion for us results sufficing fully."

3. 14159265358979323846264338327950.

* * *

The city service commission will meet Tuesday night and probably will confirm the provisional appointment of Gabriel Harmon as *playground engineer*. Mr. Harmon is at present an assistant engineer with the land commission, assigned to playground work. Gilbert Clegg will succeed him in the land commission and will become his assistant.—Milwaukee *Journal*.

Engineering Societies

Calendar

Annual Meetings

AMERICAN SOCIETY FOR TESTING MATERIALS, Philadelphia, Pa.; Annual Meeting, Atlantic City, N. J., June 23-28, 1924.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION, University of Pittsburgh; Annual Meeting, Boulder, Colo., June 25-28.

NEW ENGLAND WATER WORKS ASSOCIATION, Boston, Mass.; Annual Meeting, Rochester, N. Y.; Sept. 30 to Oct. 3.

AMERICAN SOCIETY FOR MUNICIPAL IMPROVEMENTS, St. Petersburgh, Fla.; Annual Convention, Boston, Mass., Sept. 29-Oct. 3, 1924.

The New England Water Works Association will hold its annual outing June 25 at Plymouth, Mass., at Hospitality Hall by courtesy of the Plymouth Cordage Co., and the engineering feature will be inspection of the manufacture of pipe at the water department shop.

The Providence, R. I., Engineering Society at its annual outing June 21 will take an automobile trip to Twin Elm Farm, Harmony, R. I., with sports, dinner and dancing as features.

The Southern California Chapter of the Associated General Contractors held its fifth annual banquet and jubilee June 5 in the Biltmore Hotel, Los Angeles.

Personal Notes

R. R. COOK, valuation engineer of the Chicago & Alton R.R., has been appointed chief engineer, to succeed the late H. T. Douglas. J. R. Hoagland is promoted to be valuation engineer.

ELMER E. BARNARD has been appointed a member of the Virginia State Board for the Examination and Certification of Professional Engineers, Architects and Land Surveyors, to fill out the unexpired term of the late Major Peyton B. Winfree, which ends in 1928. Mr. Barnard is engineer of way and structures of the Lynchburg Traction & Light Co., Lynchburg, Va., and of the Roanoke Railway and Electric Co., Roanoke, Va.

S. R. WESTON, St. John, N. B., has been appointed chief engineer of the New Brunswick Power Commission; Mr. Weston has been acting as chief engineer since the retirement of C. O. Foss some time ago.

FREDERICK W. IVES, professor and head of the department of agricultural engineering at Ohio State University, has been elected president of the American Society of Agricultural Engineers, succeeding S. H. McCrory of the U. S. Department of Agriculture. Professor Ives is a consulting agricultural engineer and an authority on farm structures. He had previously served the society as secretary-treasurer, member of the council, chairman of a number of committees and society representative of American Engineering Council.

C. C. THORNBURG, civil engineer, formerly with the Monongahela Railway Co., is now associated with J. D. Spinks, municipal engineer of Winston-Salem, N. C.

K. E. LANCET, senior assistant road engineer of the Indiana State Highway Commission, has resigned to become associated with James H. Carnine, civil and structural engineer, Indianapolis, Ind., specializing in the design and sale of steel building materials. Mr. Lancet is a civil engineering graduate of Rose Polytechnic Institute. In the World War he served as a company commander in the 131st Engineers.

H. G. ACRES, who has just retired as chief hydraulic engineer from the Ontario Hydro-Electric Power Commission, was awarded the degree of Doctor of Science at the convocation of the University of Toronto on May 30. Mr. Acres had been connected with the Ontario commission for a number of years and has been the active head of design and construction of the Queenston-Chippawa plant just completed. He now is to engage in private practice in Toronto, but will continue to act as consultant for the commission.

W. C. CAYE, JR., formerly a division engineer for the Georgia State Highway Department, has, with D. R. Andrews organized the Caye-Andrews Co. for engineering and contracting work in the southern section of Georgia; the company will confine its activities entirely to state and county bridge and road construction. Mr. Caye is in charge of the engineering work, and Sherley Hudson, a former resident engineer for the Georgia State Highway Department, is in charge of the construction work.

T. H. HOGG, a civil engineering graduate of Toronto University, has been appointed chief hydraulic engineer of the Ontario Hydro-Electric Power Commission, succeeding Henry G. Acres.

E. H. MCGOVERN has been promoted to engineer, maintenance-of-way, for the New York Central Lines, on the Cleveland, Cincinnati, Chicago & St. Louis Ry., St. Louis Division. C. F. HINCHMAN succeeds Mr. McGovern as engineer of maintenance-of-way on the Cairo Division. W. B. HODGE succeeds Mr. Hinchman in the same position on the Indianapolis Terminal and Springfield Division. B. S. DICKERSON succeeds Mr. Hodge in the same position on the Evansville, Indianapolis & Terre Haute Ry. H. C. LORENZ is appointed office engineer for these two roads and the Cincinnati Northern, at Cincinnati, vice Mr. Dickerson.

FRED G. SIMMONS, former state engineer of Oklahoma, has been appointed manager of the Contractors' Association of Northern California with headquarters in San Francisco. Before going to Oklahoma, Mr. Simmons was construction and maintenance engineer for the Electric Railway and Light Co. of Milwaukee, and then commissioner of public works in Milwaukee for five years.

Obituary

COLONEL ALFRED LA MAR, engineer, Weehawken, N. J., died at his home recently from a heart attack, aged 53 years. Colonel La Mar was vice-president of the Foreign Trades Corporation, New York, until he retired recently. During the war he was commissioned a lieutenant colonel to serve the commercial and engineering departments of the army abroad, and later served in the reconstruction of the devastated countries. He was decorated by the French, Belgian and Polish Governments.

FRANKLIN M. HARRIS, founder of the firm of Franklin M. Harris & Co., building contractors, died June 9 at his home in Philadelphia in his 85th year. The firm, which was formed in 1889, has erected many large structures in Philadelphia.

DUNCAN BUIE, since 1917 state highway engineer of Louisiana, and during 1922 vice-president of the Louisiana Highway Commission, died suddenly in Baton Rouge while on a visit to friends. Mr. Buie was 53 years of age and a native Louisianian.

JAMES KENNEDY, irrigation expert and assistant engineer in the office of the county engineer of Sacramento County, died in Sacramento, Calif., May 27 of pneumonia; he was 73 years of ago. Mr. Kennedy was a graduate of Cornell University.

MAJOR FRANK B. GILBRETH, internationally known consulting engineer, Montclair, N. J., and president of Frank B. Gilbreth, Inc., died suddenly June 14 in a telephone booth in a railroad station in Montclair, his death being due to heart disease; he was 56 years old. Major Gilbreth's consulting work lay chiefly in the field of industrial management and he had clients in many countries. He made a special study of motion and waste elimination in the industries, and also was the inventor of many machines and devices for increasing the efficiency of workers. He was a contracting engineer in Boston from 1895 to 1904 and in New York until 1911 when he began consulting practice. Major Gilbreth was commissioned major of engineers in 1917 and assigned to duty at the War College at Washington.

SIDNEY GRIGGS, engineer, formerly connected with the main offices of the California State Highway Comimssion at Sacramento, died in Southern California recently. Mr. Griggs was transferred to the Los Angeles division of the commission about a year ago. At one time he was connected with the engineering department of the Southern Pacific R.R.

GABRIEL F. KINTZ, former surveyor of Adams County, Ind., and city engineer of Decatur, Ind., died recently at the home of a daughter in Toledo, Ohio, following a brief illness of paralysis.

From the Manufacturer's Point of View

A Point of Contact Between Maker and User of Construction Equipment and Materials

Manufacturers' Groups Report Progress in A.G.C. Affiliation

Washington Correspondence

Steady but slow progress is being made in the plan to organize manufacturers and dealers of construction equipment and supplies into a system of affiliated bureaus of the Associated General Contractors of America, in order to provide means of contact for a mutual benefit. Manufacturers of concrete mixers, who have already voted to organize an affiliated bureau of the A. G. C. will meet before July 1 in order to perfect the details of their organization. The place of meeting probably will be Chicago; the exact date will be fixed within the next few days.

Hollow-metal door manufacturers, one of the groups of the metal equipment industry, who held a conference with officials of the Associated General Contractors recently and decided to survey their field more fully before taking definite action, have decided first to form an organization of their own and then reach a decision on affiliation with the A. G. C.

The metal partition section, of which R. F. Carpenter, of the Sanymetal Products Co., is chairman, has been called to meet in Buffalo, June 20, to take further action on formation of an affiliated bureau.

Long Timbers Shipped

A shipment of unusually long timbers has just been made by the Pacific National Lumber Co., Tacoma, Wash., to Kanauga, Ohio. The load, consisting of 24 pieces of 8x14-in. by 128-ft. timbers, which are to be used in the construction of barges, required three railroad flat cars for their support. The accompanying photo shows the shipment.

THREE FLAT CARS REQUIRED TO SHIP 128-FT. TIMBERS

Record Automobile Production

Automobile production for the first five months of 1924, as reported to the directors meeting of the National Automobile Chamber of Commerce in New York, June 4, is 1,742,832. This figure is the highest ever recorded for the initial five months of any year and is 94,000 above the total for the similar period in 1923.

Pipe Line, 210 Miles Long, Will Have Welded Joints

Work has just started on the construction of a 16-in. steel pipe line, 210 miles long, for carrying high-pressure natural gas from Shreveport, La., to Beaumont, Tex. It is being built by the Magnolia Gas Co., with construction headquarters in Kirbyville. The joints in the line will be formed by oxyacetylene welding and will constitute, it is claimed, one of the largest welding operations of this type ever undertaken. It is planned to complete the work in about three months and to employ 100 skilled pipe welders on the line. The gases and the equipment for the welding operations are being supplied by the Linde Air Products Co. of New York.

Paving Brick Shipments Increase Despite Late Season

Substantial increases in stock on hand, unfilled orders, production and shipments are reported in the paving brick industry for April, according to the monthly statistical report of the National Paving Brick Manufacturers Association. A rainy spring is acting as a retarding influence in some portions of the country.

Production for April was 22,750,000 brick as against 21,656,000 for March. Shipments in April were 15,827,000 as against 10,989,000 for March. Stock on hand showed an increase from 117,451,000 in March to 122,123,000 in April. Unfilled orders jumped from 78,347,000 in March to 83,184,000 in April. The foregoing figures were furnished by manufacturers representing only 65 per cent of the normal tonnage capacity of the industry. Total figures for the entire industry would be substantially larger.

Of total shipments nearly 12,000,000 were for city streets as against almost 3,000,000 for rural highways. Ohio led with shipments of 546,000 for city streets and 1,931,000 for rural highways. Texas was second with 1,882,000 for city streets. Oklahoma was third with 1,419,000 for city streets and 449,000 for country highways. Illinois and Minnesota ran fourth and fifth respectively.

Centrifugal Pipe Now Cast in Sand Molds

New Sand-Spun Process Eliminates Water-Chilled Molds and Need for Annealing

Sand-spun pipe is the name applied to the product of a new centrifugal process of cast-iron pipe manufacture developed recently through the joint experimental work of a group of manufacturers including R. D. Wood & Co., Philadelphia; American Cast Iron Pipe & Foundry Co., Birmingham, Ala.; Warren Foundry & Pipe Co., New York; Donaldson Iron Co., Emaus, Pa.; Lynchburg Foundry Co., Lynchburg, Va.; and the Glamorgan Pipe & Foundry Co., Lynchburg, Va. The experimental work on the sand-spun pipe was conducted at the Birmingham plant of the American Cast Iron Pipe & Foundry Co. In place of the water-chilled mold of the DeLavaud centrifugal pipe-casting process, previously described in this journal, the new process utilizes a revolving sand mold, one of the advantages of which is the elimination of the annealing treatment required in the case of pipe cast in a chilled mold.

In carrying out the sand-spun method, the metal, at predetermined temperature, is poured rapidly into a revolving sand-lined flask, against which the metal is cast without any chilling action. Centrifugal action serves to distribute the molten metal throughout the length of the mold, thus producing a pipe of uniform thickness from end to end. The speed of revolution causes the metal to be exceedingly dense, increasing its tensile strength by more than 50 per cent, and making it tough and hard to fracture. The new process, the manufacturers point out, does not produce a metal which is difficult to drill, thread or tap.

With the revolving sand-lined flask the pipe may be cast of any thickness, heavy or light. Both the bell and the spigot or bead ends can be formed by the new method as easily as by the old sand cast method, which is held to be impossible in a metal or chilled mold. A refractory lining, applied to the sand mold before casting, prevents the burning of the sand to the iron and avoids all scabbing. During the casting operation this lining becomes incorporated, by a fusing action, with the outer shell of the casting, thus forming a coating which prevents rust.

Cast iron pipe made by the new process in centrifugal sand-lined molds, according to the manufacturers, has been thoroughly tested in hydraulic presses to 2,400 lb. per sq.in. without showing defects. Bars made from the actual castings have shown more than 30,000 lb. in tensile strain. The new sand-spun pipe is now being regularly manufactured and marketed. Enlarged foundries are being built and old plants reconstructed for the installation of the new method, which is protected by patents covering both the process, the machinery and the product. The new process, up to the present, is confined to a range of sizes between 4 and 12 in. in diameter. A ½-in. cement mortar lining may be spun.

New Attorney General To Study Trade Association Status

Washington Correspondence

Some clarification of the trade statistics situation is in prospect as a result of the change in attorneys general. Mr. Daugherty gave this controversy very little personal attention, but he was willing to stand behind certain of his assistants who have assumed what is regarded both in and out of government circles as an unreasonable attitude. It is believed that the new attorney general will insist on determining this policy for himself. It is known positively that he has not given study to the subject, but he recognizes the importance of having some determination of the matter.

The same staff is on duty at the Department of Justice under the new Attorney General as was the case when Mr. Daugherty was in office. There is reason to believe, however, that Mr. Stone will not leave the determination of such important policies to subordinates. It is understood that he is acquainting himself thoroughly with the situation and is willing to take into careful consideration any suggestions which may be forthcoming from those who believe trade statistics are in the public interest.

Business Notes

F. B. LEOPOLD CO., INC., Pittsburgh, has been organized to take over the business established by F. B. Leopold since the liquidation of the Pittsburgh Filter & Engineering Co. with which he was connected for many years in charge of the design and construction of water filtration and softening plants. The new organization is composed of old employees of the Pittsburgh Filter Co. with Mr. Leopold at its head and is equipped to design and construct filter plants and furnish apparatus, including dry chemical feed machines, operating tables, gages, and controllers.

TRINITY PORTLAND CEMENT CO., Dallas, Tex., has begun the construction of a 500,000-bbl. cement plant at Fort Worth, Tex. The new plant will be operated in conjunction with the company's existing works at Dallas and on completion of the Fort Worth unit the company's total annual output will approximate 2,000,000 bbl. The existing Dallas plant, which started operation in 1909, now has a capacity of 1,500,000 bbl. yearly.

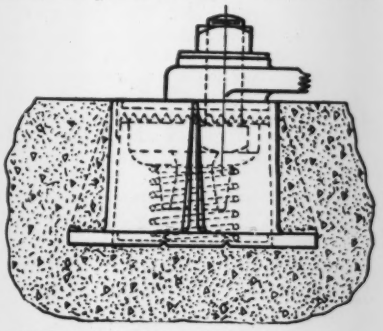
SECURITY CEMENT & LIME CO., Hagerstown, Md., has acquired the patent rights to Cal hitherto held by the Cal Chemical Co. of Hagerstown. Cal is a material for controlling the set and increasing the early strength of portland cement. Richard H. Catlett will be manager of the Cal department of the Security Cement & Lime Co. and B. C. Lightner, formerly sales manager of the Cal company will continue his connection with the product in the sales department of the Security organization.

Equipment and Materials

New Adjustable Insert for Machine Mounting

For the purpose of fastening machinery or other equipment to concrete floors, walls or ceilings a new adjustable bolt insert has been designed by the Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa. When bolts are embedded directly in the concrete, unless extreme care is exercised, they do not always register correctly with the mounting bolt holes of the apparatus to be installed. The Westinghouse insert, however, permits an adjustment of the bolt position after the concrete has set.

The adjustable insert consists of a cast-iron housing with a tapering body



and containing a rotatable bolt carrier. The bolt carrier is T-slotted to take the head of a standard machine bolt and is of sufficient length to permit a ⅝-in. movement of the bolt from the center. Since the carrier can be rotated, the adjustment of the position of the bolt can be secured in any direction. The housing and bolt carrier are provided with teeth which mesh and prevent any change in position after the adjustment has been made and before the bolt has been tightened. The teeth are kept in mesh by a retaining spring which is held in by a sheet metal plate.

Material Gives Gypsum Wallboard Textured Finishes

Textone is a new decorative material developed and recently put on the market by the United States Gypsum Co., Chicago, Ill. It is intended primarily for use with Sheetrock, the fireproof gypsum wallboard, in producing textured finishes, including grained, stippled or mottled surfaces and in blended colors and antique plaster effects imitating stone, leather, fabric and bark. It is sold as a white, dry powder to be mixed with water at the job and applied by brush in a single coat after the wall is sized. It spreads freely and dries slowly enough to permit stippling. One pound of it will cover about 1½ sq.yd. for medium stipple. A pound of Textone Size will cover approximately 75 sq.yd.

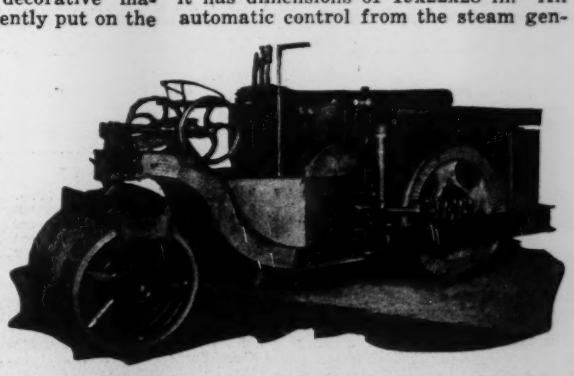
For one-coat tinted effects, pigment colors thinned in turpentine or dry colors dissolved in water are added to the material before application. Polychrome effects may be obtained by the application of Textone Glaze, a special oil medium developed for use over the foundation coat to emphasize the texture. The glaze may be tinted with pigments ground in oil or japan.

Tandem Road Roller Operated by Rotary Steam Engine

Ability to reverse instantly, thereby preventing the formation of hard spots in asphalt pavement, is made possible in the latest type of road roller placed on the market by the Erie Machine Shops, Erie, Pa., by substituting for the reciprocating form of steam engine used on previous models the Baker rotary steam generator unit, consisting of a group of six cylinders which are mounted so as to rotate around the shaft and form the fly-wheel of the engine. The new rollers, which are of the two-wheel tandem type, are built in sizes of 3, 5, 8, and 10 tons. Steam for the engine is supplied by a compact boiler with seamless tubing heated by an oil burner using fuel oil or kerosene.

Among the advantages claimed for the rotary engine are great starting torque and no dead center. The engine with a rating of from 20 to 30 hp. has six cylinders with 3-in. bore and 3-in. stroke, the overall vertical and transverse dimensions being slightly less than 24 in. This unit is designed for steam pressures of from 250 to 800 lb. per square inch. The admission of steam to the cylinders is controlled by a special design of balanced rotary valve. The weight of the 20-30 hp. steam engine, with water pump attached, is 275 lb. and the engine operates at speeds up to 1,200 r.p.m. Lubrication is accomplished by means of a dual pressure system. Due to the fact that three cylinders are always applying effort, the flow of power from the engine, it is claimed, is uniform.

The weight of the steam boiler to operate the 20-30-hp. engine is 375 lb.; it has dimensions of 19x22x28 in. An automatic control from the steam generator regulates the oil burner.



The photo above shows the power plant and drive of the roller.

Business Side of Construction

FACTS AND EVENTS THAT AFFECT COST AND VOLUME

Spain Inaugurates Big Construction Program

In accordance with a decree recently issued by the Spanish dictator, General Primo de Rivera, an extensive construction program has been outlined, dealing with the development of national steam and electric railway systems, highways, hydro-electric power projects and various industries.

The plan provides for the construction of 2,500 kilometers of new railways, running from Hendaye to Algeciras and from Madrid to Valence, Requena, Baeza, and Alpujarra.

Development of all waterfalls necessary for furnishing the hydro-electric power and also the construction of blast furnaces and chemical plants are included in the program.

The railways and industries, though the property of the state, will probably be exploited by Anglo-American interests, from which source financial aid is also expected. The operating syndicates will be expected to furnish three billion gold pesetas on the condition that the Spanish government guarantee an interest rate of 5 per cent. The necessary machinery will be purchased in the United States and

(*Continued on p. 1082*)

Business Briefs

Call money, week of June 9 ranged from 2 to 2½ per cent.

Time money rates were 3@4 per cent.

Commercial paper called for 4@4½ per cent.

Foreign Exchange Demand

	June 13	Week Ago	Year Ago
Sterling	$4.31⅜	$4.31	$4.61⅛
Franc	0.0525	0.0512½	0.0630½
Lira	0.0435	0.0434½	0.0461½

Bids Wanted on Big Jobs

Among the projects on which bids are either asked or will soon be called for in Construction News, pp. 357 to 368, are the following:

Methodist Sanitarium, Ft. Worth, Tex., $1,000,000.

School, Lowville, N. Y., for the Board of Education, $500,000.

Recent Unit Bids From Large Contracts

Acquaintance with construction cost in various parts of the country may be had by studying the unit prices in awarded contracts published weekly in the Construction News section of *Engineering News-Record*.

The accompanying tabulation of unit prices of various materials and operations has been compiled from important contracts awarded during the past month.

UNIT PRICES ON IMPORTANT MATERIALS AND OPERATIONS IN RECENTLY AWARDED CONTRACTS

Location	Date of Issue	Size of Job	Unit Bid		Successful Contractor
Water-works					
Cleveland, O.	May 1	1,875 tons 60 in. c.i. pipe	$184,267.00		J. Connelly Constr. Co., Cleveland
Minneapolis, Minn.	May 1	3 Venturi meters	5,205.00		Builders Iron Fdry. Co., Providence, R. I.
		10 rate controllers	14,900.00		
Dunkirk, N. Y.	May 8	1-8 m.g. capacity water pump	41,975.00		Worthington Pump & Machy. Corp., New York City
Cleveland, O.	May 8	2,630 tons 60 in. c.i. pipe	261,948.00		D. Lowensohn Co., Cleveland
Sewers					
Cleveland, O.	May 15	4,220 ft. 24 in. vitr. clay sewer	$34,953.00		Joseph Co., Cleveland
North Milwaukee, Wis.	May 15	10,380 lin.ft. 8 in. vitr. clay sewer	$2 to 2.30	per lin.ft.	G. W. Mulholland, Rockford, Ill.
Excavation					
Milwaukee, Wis.	May 8	Dredging 133,600 cu.yd.	$0.4375	per cu.yd.	Great Lakes Dredge & Dock Co., Milwaukee
Osceola, Ark.	May 8	Excavating 575,000 cu.yd.	.13	per cu.yd.	McWilliams Co., Memphis, Tenn.
Norfolk, Neb.	May 15	Excavating 80,000 cu.yd.	.124	per cu.yd.	Morrow & Son, Omaha
Streets and Roads					
Charleston, W. Va.	May 1	Grading and conc. paving 1 mi. 14 ft.	$23,707.00		Greybill & Bruce, Charleston
Cedar Falls, Ia.	May 1	11,360 sq.yd. 8 in. vibrolithic conc.	2.58	per sq.yd.	Dearborn Constr. Co., Waterloo
Davenport, Ia.	May 1	Concrete paving	1.68	per sq.yd.	W. D. Phelan, Davenport
		Concrete paving	1.72	per sq.yd.	Iowa Constr. Co., Davenport
		Sheet asphalt paving	2.58	per sq.yd.	Central Eng. Co., Davenport
		Bitulithic paving	2.69	per sq.yd.	McCarthy Impv. Co., Davenport
Taylorville, Ill.	May 8	3,575 cu.yd. excav.	.65	per cu.yd.	Alzina Constr. Co., Springfield, Ill.
		5,022 lin.ft. curb and gutter	1.15	per lin.ft.	
		5,225 sq.yd. brick paving	3.83	per sq.yd.	
Wisconsin	May 8	25,994 cu.yd. earth excav.	.65	per cu.yd.	Hayes Bros., Zanesville, Wis.
		85,377 sq.yd. conc. surfacing	1.18	per sq.yd.	
		8,700 sq.yd. rock asphalt	3.18	per sq.yd.	
Ft. Worth, Tex.	May 8	6,000 ft. curb and gutter	1.00	per ft.	West Texas Constr. Co., Ft. Worth
		3,500 cu.yd. excav.	.90	per cu.yd.	
Oklahoma City, Okla.	May 8	6,300 sq.yd. asphalt	3.88	per sq.yd.	Western Paving Co., Oklahoma City
		2,100 cu.yd. excav.	.98	per cu.yd.	
Winfield, W. Va.	May 15	1 mile macadam surfacing	34,360.00		Smith & Vander, Nitro
Estherville, Ia.	May 15	Grading 88,040 cu.yd.	.265	per cu.yd.	O'Hanlon & Reilly, Omaha, Neb.
		Grading 34,578 cu.yd.	.27	per cu.yd.	
		Grading 30,705 cu.yd.	.28	per cu.yd.	
Los Angeles, Calif.	May 15	54,486 sq.ft. asphalt	.23	per sq.ft.	Griffith Co., Los Angeles
		11,374 sq.ft. oil and roll	.07	per sq.ft.	
		26,496 sq.ft. warrenite-bitulithic	.265	per sq.ft.	
		3,442 sq.ft. bituminous	.12	per sq.ft.	
Federal Government					
Providence, R. I.	May 1	280,000 cu.yd. excav.	$0.209	per cu.yd.	J. S. Packard Dredging Co., Providence
Florence, Ala.	May 8	Wilson Dam 20,000 bbl. cement	2.208	per bbl.	Atlas Portland Cement Co.
		Wilson Dam 20,000 bbl. cement	2.24	per bbl.	Phoenix Portland Cement Co.
		Wilson Dam 10,000 bbl. cement	2.11	per bbl.	Dixie Portland Cement Co.
		Wilson Dam 6,000 bbl. cement	2.25	per bbl.	Lehigh Portland Cement Co., Birmingham
Material and Equipment					
St. George, N. Y.	May 1	Trucks 1½ ton auto with dump body	$2,585.00		Kruger Motor Car Co., St. George
		Trucks 2 ton auto with dump body	2,685.00		
Minneapolis, Minn.	May 1	2 gasoline operated bucket loaders	1,644.00	each	W. H. Kuhlman & Co.
		Motor driven pickup street cleaner	6,466.00		Elgin Sales Corp.
		Street flusher	2,135.00		Galion Iron Wks. & Mfg. Co., Minneapolis
St. Paul, Minn.	May 1	One 12 ft. heavy dirt road grader	1,848.00		Austin Western Road Mchy Co.
		One 8 ft. road grader roller bearings	730.00		Russell Grader Mfg. Co., Minneapolis
Minneapolis, Minn.	May 8	200,000 gal. road oil	0.0615		Roxanna Petroleum Corp., Chicago, Ill.